THE

JOURNAL OF GAS LIGHTING,

WATER SUPPLY, & SANITARY IMPROVEMENT.

[REGISTERED AS A NEWSPAPER.]

VOL. XXXV. No. 889.] LONDON, MAY 25, 1880. [32ND YEAR. Price 6d.

GAS PURIFICATION

BY

OXIDE OF IRON.

COOKE BROS.,

CENTRAL DEPÔTS:

CO. DONEGAL, IRELAND;

LONDON DEPÔT:

ERITH,

OFFICES:

2, CROSBY SQUARE,

LONDON, E.C.

GENUINE TORBAY PAINT

And SPECIAL GASOMETER PAINT.

SEVERAL PRIZE MEDALS. ESTABLISHED OVER 20 YEARS.

These Paints are now used by all the London Gas Companies and most of the principal Country Gas Companies, on Gas-holders, Scrubbers, Purifiers, &c. Also used by the Admiralty, War Office, Railway Companies, Founders, &c. They prevent and arrest rust, and protect iron from the action of water, sulphurous and gaseous exhalations; do not crack, blister, or flake off; will cover tar effectually.

The covering powers are considerably greater than those of any other Paint.—*See "Engineer," Nov.* 2, 1866.

Supplied, mixed ready for use, or in paste, as desired.

TORBAY PAINT COMPANY.

PROPRIETORS: STEVENS & CO.,

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WORKS: BRIXHAM, TORBAY.

TUBES.

Tubes and Fittings for Gas, Steam, Water, and Hydraulic purposes, plain, galvanized, white enamelled inside, or coated by Dr. Angus Smith's process, or oxidized by Professor Barff's patent process. Gas-fitters tools, brass cocks, &c.

JOHN SPENCER,

VULCAN TUBE WORKS,

WEST BROMWICH, STAFFORDSHIRE,

AND

97, CANNON STREET, LONDON.

COWEN'S PATENT FIRE-CLAY RETORTS.

JOSEPH COWEN and CO.,

BLAYDON BURN, BLAYDON-ON-TYNE,

Were the only parties to whom a PRIZE MEDAL was awarded at the GREAT EXHIBITION of 1851, for "GAS-RETORTS and OTHER OBJECTS in FIRE-CLAY," and they were also awarded at the INTERNATIONAL EXHIBITION of 1862, the PRIZE MEDAL for "GAS-RETORTS, FIRE-BRICKS, &c., for EXCELLENCE of QUALITY."

J. C. and Co. have been for many years the most extensive Manufacturers of Fire-Clay Retorts and Fire-Bricks in the Kingdom. Orders for Fire-Clay Retorts of all shapes and dimensions, and to fit any shaped Mouthpiece, Fire-Bricks, and every other article in Fire-Clay, are promptly executed at their Works as above.

COWEN'S GARESFIELD COALS.

JOS. COWEN & Co. are the only Manufacturers of FIRE-BRICKS and CLAY RETORTS at BLAYDON BURN.

JOHN RUSSELL & CO.,

LIMITED,

Established at the commencement of Gas Lighting,

MANUFACTURERS OF

TUBES AND FITTINGS.

THREE PRIZE MEDALS,

Paris, 1878.

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145, QUEEN VICTORIA STREET.

ALMA TUBE-WORKS, WALSALL;

OLD PATENT TUBE-WORKS, WEDNESBURY.

JOHN BENT & SON,

BELL BARN ROAD, BIRMINGHAM,

MANUFACTURERS OF

WET AND DRY GAS-METERS,

LICENSEES AND MANUFACTURERS OF

HUNT'S

PATENT COMPENSATING METERS,

STREET-LAMPS, &c., &c.

ESTABLISHED 1830.

THOMAS PIGGOTT & CO.,

SPRING HILL, BIRMINGHAM,

MANUFACTURERS OF

TELESCOPIC & SINGLE GASHOLDERS,

CAST & WROUGHT IRON TANKS FOR DITTO,

And Gas Apparatus of every Description.

Marine, Tubular, Cornish, Plain, Furnace, Saddle, and Range Boilers.

SUGAR, SALTPETRE, AND ALL KINDS OF PANS.

Roofs, Girders, and Bridges, and General Smith's Work.

London Offices: 97, CANNON STREET—

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THE

"OTTO" GAS-ENGINE,

From ½ to 40 H.P. ind.

See Page 782.

CROSSLEY BROTHERS,

MANCHESTER AND LONDON.

THE

DUKE OF HAMILTON'S

LESMAHAGOW

CANNEL COAL.

AGENT:

JAMES M'KELVIE,

HAYMARKET,

EDINBURGH.

ESTABLISHED 1840.

GEORGE GLOVER AND CO.,

PATENTEES OF THE

NATIONAL STANDARD GASOMETERS

AND MANUFACTURERS OF

IMPROVED DRY GAS-METERS.

GOLD MEDAL. HIGHEST AWARD.

INTERNATIONAL EXHIBITION,

SYDNEY, 1880.

RANELAGH WORKS, ROYAL AVENUE, CHELSEA, LONDON, S.W.

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Foreign Agents: DAHL BROS. Copenhagen; A. FAAS & CO., Frankfort-on-Maine; W. HOVEN & SON, Rotterdam COPLAND & M'LAREN, Montreal; A. DEMPSTER, 67, Elizabeth Street, Melbourne.

WELLINGTON TUBE WORKS,

GREAT BRIDGE, TIPTON, STAFFORDSHIRE.

JOSEPH AIRD,

GAS, STEAM, AND HYDRAULIC TUBES AND FITTINGS.

NO MORE WASTE LIME! SAVE THE VALUABLE PRODUCT!

G. R. HISLOP'S PATENT REGENERATIVE PROCESS

Most Effectively and Economically restores this waste *ad infinitum*.

The Patentee having devoted more time and attention to this subject than perhaps any other person living, is now in a position to recommend the adoption of this process to Gas Companies and Corporations with the utmost confidence in its practical utility, convenience, and economy. 1st. It restores the spent Lime at from one-third to one-half its original cost, apart from its undoubted convenience and the economy of space. 2nd. There is practically no limit to the duration of the Lime. 3rd. The cost of apparatus for the introduction of the process is very moderate and exceedingly durable. 4. The Patentee supplies special bricks and castings, erects and proves the process on the most favourable terms.

The process, in operation, may be seen at the Corporation Gas-Works, Paisley, where the Lime has been restored 120 times. Inspection is cordially invited.

For Terms, apply to GEO. R. HISLOP, F.C.S., Engineer, Gas-Works, PAISLEY, N.B.

ROBT. DEMPSTER & SONS,

GAS ENGINEERS, IRONFOUNDERS, AND CONTRACTORS,

ROSE MOUNT IRON-WORKS, ELLAND, YORKSHIRE.

MANUFACTURERS OF EVERY DESCRIPTION OF

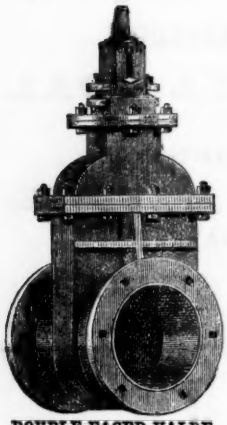
GAS APPARATUS;

CONTRACTORS FOR THE

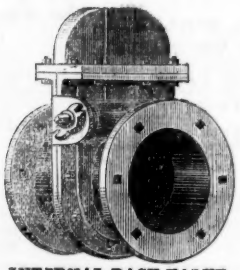
ERECTION OF PUBLIC AND PRIVATE GAS-WORKS.

Plans and Specifications Prepared, and Illustrated Catalogues forwarded on application.

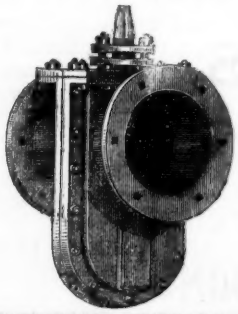
C. & W. WALKERS' GAS-VALVES.



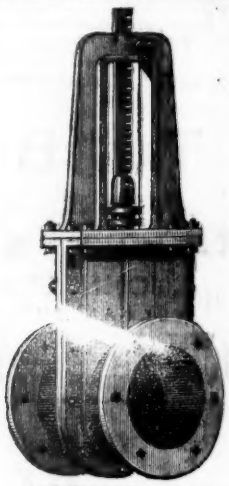
DOUBLE-FACED VALVE SPECIALLY FOR PURIFIERS.



INTERNAL RACK-VALVE WITH STEEL PINION, FOR GENERAL USE.



UNDERGROUND SCREW-VALVE FOR SHALLOW STREET-MAINS.



ORDINARY RACK AND PINION VALVE.

MIDLAND IRON-WORKS,

DONNINGTON, near NEWPORT, SHROPSHIRE; 8, FINSBURY CIRCUS, LONDON.

TRADE MARK.

THE MEDAL FOR 1862.

The only Prize Medal awarded for TUBES & FITTINGS.

CROWN TUBE-WORKS,

WEDNESBURY, STAFFORDSHIRE.

WAREHOUSE: SOUTHWARK STREET, LONDON.

JAMES RUSSELL & SONS, LIMITED,

PATENTEES & FIRST MAKERS OF WROUGHT-IRON TUBES,

ONLY MAKERS OF HOMOGENEOUS METAL TUBES.

MANUFACTURERS OF

TUBES and FITTINGS for GAS, STEAM, and WATER;

LAP-WELDED, LOCOMOTIVE, MARINE, and other BOILER TUBES;

HYDRAULIC TUBES, BEDSTEAD TUBES, WELL TUBES, TELEGRAPH POSTS, COILS, &c.,

GAS-FITTERS TOOLS, VALVES, COCKS, &c.

THOMAS PIGGOTT & CO.,

(Established 1822,)

SPRING HILL, BIRMINGHAM.

MANUFACTURERS OF

TELESCOPIC & SINGLE GASHOLDERS,

CAST & WROUGHT IRON TANKS FOR DITTO;

PURIFIERS, CONDENSERS, SCRUBBERS, RETORTS, VALVES;

IMPROVED WROUGHT-IRON RETORT-LIDS, CROSS-BARS, & SCREWS;

AND GAS APPARATUS OF EVERY DESCRIPTION.

SOLE MANUFACTURERS OF LIVESEY'S PATENT GASHOLDER MAN-LID,

By use of which Man-lid, inlet and outlet pipes can be examined and cleansed without loss of gas in crown of holder, or ingress of atmospheric air.

ROOFS, GIRDERS, BRIDGES, AND BOILERS OF ALL KINDS.

Drawings, Specifications, and Estimates supplied on application.

LONDON OFFICES: 97, CANNON STREET—JAMES E. & SAMUEL SPENCER, AGENTS.

EDWARD E. CROMBIE & CO.,

INVENTORS AND PATENTEES

OF THE

FRICTIONLESS DRY GAS-METERS,

Beg to intimate to Gas Companies and others that they are now prepared to supply these very superior Meters at the same prices as for the ordinary Gas-Meters.

In the construction of this Meter, for which the best tin plates only are used, every mechanical contrivance has been taken advantage of successfully to reduce the friction to a minimum, which is amply proved by the fact that they are made to work upon only one-fortieth of an inch pressure. By an improvement also in their construction, a steadier light is obtained, and greater capacity than can be got from any other Meter in the market. No gas can pass under the valves on any back pressure, as is the case with many other Dry Meters.

To Gas Companies supplying gas through streets with heavy gradients, these Meters are invaluable, as much gas is saved from the low pressure required to work them.

ALL METERS ARE UPHELD FOR FIVE YEARS.

METROPOLITAN WORKS, DIANA PLACE, EUSTON ROAD, LONDON, N.W.

PARIS EXHIBITION,
1878.

THREE MEDALS
AND
HONOURABLE MENTION
HAVE BEEN AWARDED TO
JOSEPH CLIFF & SONS
For their Various Exhibits, amongst which is a
SILVER MEDAL
FOR THEIR
PATENT MACHINE-MADE
RETORTS AND FIRE-BRICKS,
Being the Highest Honour given for this class.

Established

1795.

JOSEPH CLIFF & SONS,

THE ORIGINAL

WORTLEY FIRE-BRICK WORKS,

NEAR LEEDS,

London Wharf: No. 4. inside Great Northern Goods Station, King's Cross, N. Liverpool: Leeds Street.

SPECIAL NOTICE.—Our Patent Machine-Made Retorts have now been thoroughly tested, and have proved themselves infinitely superior to those made by hand. At several large works it has been settled, beyond question, that, owing to the compactness and general excellence, more gas is sent to the gasholder from each ton of coal carbonized than is the case with hand-made Retorts.

DANIEL HOWARD,

(Successor to the late BENJ. WHITEHOUSE),

GASHOLDER AND BOILER WORKS,

WEST BROMWICH, NEAR BIRMINGHAM (Established 1765),

MANUFACTURER OF

TELESCOPIC AND SINGLE GASHOLDERS,

WROUGHT AND CAST-IRON TANKS FOR DITTO.

PURIFIERS, CONDENSERS, SCRUBBERS, HYDRAULIC MAINS, AND ALL KINDS OF GAS APPARATUS.

WROUGHT-IRON ROOFS, BRIDGES, GIRDERS, ETC.

STEAM, HOT WATER, AND RANGE BOILERS, TANKS, CISTERNS, BOATS,

AND ALL KINDS OF WROUGHT-IRON WORK.

Drawings, Specifications, and Estimates supplied on application.

GAS PURIFICATION

BY

OXIDE OF IRON.

GAS PURIFICATION & CHEMICAL Co., LIMITED,

PALMERSTON BUILDINGS, OLD BROAD STREET, LONDON, E.C.

JOHN WM. O'NEILL, Managing Director.

GAS *v.* ELECTRIC LIGHT.

WIGHAM'S PATENT LIGHTHOUSE GAS-BURNERS,

For Street Lighting and the Illumination of Large Halls, Factories, Ship Yards, &c., where Powerful Light is required.

These Burners have been adopted by a School Board, having large school-rooms in charge, because of their high illuminating power and the facilities they give for perfect ventilation. The actinic power of these Burners is such that they are used successfully for Photography and Photo-Lithography.

SOLE MANUFACTURERS:

J. EDMUNDSON & CO., Gas Engineers, 19, GREAT GEORGE STREET, WESTMINSTER, LONDON, S.W.

GEORGE BOWER,

GAS AND WATER ENGINEER AND CONTRACTOR,

ST. NEOTS, HUNTS.

Gas Apparatus supplied for Works of any magnitude, from those suitable for experimental purposes to those capable of producing one million cubic feet per day.

VERTICAL RETORT APPARATUS for small Private Works, and for Testing Coal.

DOUBLE-ACTING RETORT APPARATUS for Producing Gas from Oil, Resin, Peat, Wood, and Coals.

RETORT-FITTINGS, CONDENSERS, SCRUBBERS, ENGINES AND EXHAUSTERS, PURIFIERS, STATION-METERS, GASHOLDERS, GOVERNORS, METERS, CENTRAL CHANGE VALVES, FOUR-WAY BYE-PASS VALVES, & VALVES OF ALL DESCRIPTIONS.

GASHOLDER TANKS, IN CAST OR WROUGHT IRON.

HIGH-PRESSURE AND CONSUMERS GAS-REGULATORS. WET AND DRY GAS-METERS.

APPARATUS FOR LIGHTING RAILWAY CARRIAGES WITH GAS.

AIR-LIGHT APPARATUS.

LAMP COLUMNS, SHADOWLESS HEXAGONAL LANTERNS on the Interchangeable Principle.

Plans, Specifications, and Estimates for Gas-Works of any magnitude.

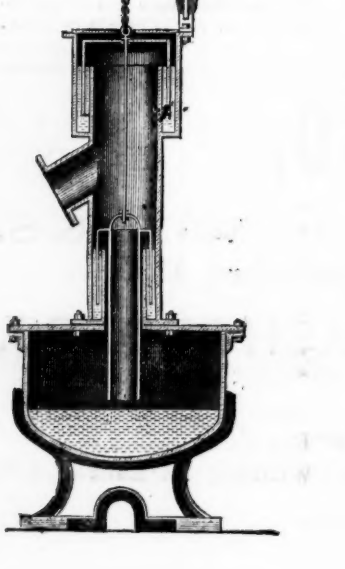
References in every Quarter of the World to Works erected during the past Quarter of a Century.

Second Edition of "The Gas and Water Engineer's Book of Reference," 4s. Companion, with Detailed Costs, 1s., post free.

SELF-ACTING REMOVABLE DIP-PIPE,

PATENTED BY

CHANDLER & STEVENSON.



The following Testimonials, as to five years constant working of this Patent Removable Dip, have been received:—

Metropolitan District Asylum Gas-Works, Caterham, Surrey, Jan. 15, 1874.

Messrs. CHANDLER and SONS.

DEAR SIRS,

In reply to your inquiries, I beg to inform you that since I have used your Patented Dips (ten in number), I find my make has increased over 1000 cubic feet per ton of coal carbonized, my usual make being 9070 cubic feet before using your Dips, and 10,150 cubic feet since using them.

Metropolitan District Asylum Gas-Works, Caterham, Surrey, Dec. 30, 1879.

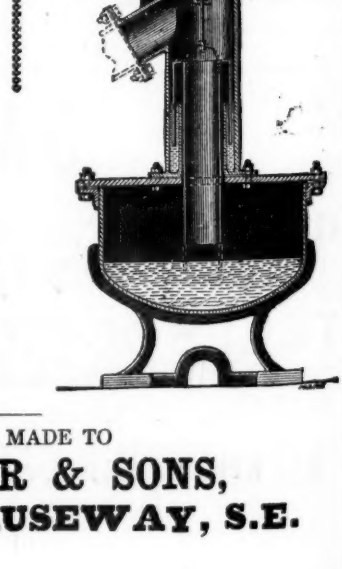
Messrs. CHANDLER and SONS.

DEAR SIRS,

In reply to your inquiry, it is with very much pleasure that I endorse every word of my letter of Jan. 15, 1874; and I may add that from the date the Patent Dips were fitted, they have worked perfectly, and there is very little carbon deposited in the retorts, in consequence of the lower pressure.

Yours faithfully,

(Signed) W. CRICKMAY,
Memb. Soc. Engineers.



APPLICATIONS TO BE MADE TO

Messrs. CHANDLER & SONS,

104, NEWINGTON CAUSEWAY, S.E.

KIRKHAM, HULETT, & CHANDLER, LIMITED.

PATENT "STANDARD" WASHER-SCRUBBER,

FOR

GAS PURIFICATION,

TAKES OUT EVERY TRACE OF AMMONIA AND A LARGE QUANTITY OF CARBONIC ACID AND SULPHURETTED HYDROGEN BY ONCE PASSING THROUGH THE MACHINE.

AMMONIACAL LIQUOR OBTAINED OF ANY REQUIRED STRENGTH.

The Cost of the Machine defrayed by the Ammonia obtained in Twelve Months.

It requires very little attention, and cannot get out of order.

THESE MACHINES HAVE BEEN SUPPLIED TO THE FOLLOWING GAS-WORKS:—

	Feet per Day.
The Gaslight Company, London—	
Beckton	5,000,000
Bromley	7,000,000
St. Pancras	3,000,000
Bradford Corporation	1,000,000
Bremen	150,000
Buxton Local Board	250,000
Dukinfield Local Board	500,000
Driffield Company	100,000
Goole Company	250,000
Glossop Company	300,000
Holywood Company	125,000
Heywood Local Board	600,000
Leeds Corporation	2,000,000
Leominster Company	150,000
Maidstone Company	1,000,000
Phœnix Company, Greenwich	2,500,000
" " Vauxhall	3,000,000
Woolwich Equitable Company	400,000
Yeadon Company	500,000

AND MANY ARE IN COURSE OF CONSTRUCTION;

Among others, four, for 3 million feet per day each, for the Corporation of Leeds; three, for 1¾ million feet each, for the Corporation of Salford; three, for 5 million feet, for The Gaslight and Coke Company, London; one, for 3 million feet, for the London Gas Company, Nine Elms, &c. &c.

TESTIMONIALS.

Messrs. Kirkham, Hulett, and Chandler. *Engine-Works, Millbank, Westminster, S.W., March* 5, 1879.

Gentlemen,—In accordance with your instructions, I have taken diagrams from Vertical Engine driving your Patent Horizontal Washer-Scrubber to purify 60,000 feet of gas per hour on the works of The Gaslight Company at King's Cross, and find the following results, viz.:—

Horse power required to drive engine, shafting, and gearing alone	= 0·398
Total horse power with washer on	= 1·721
Absolute horse power required to drive Washer-Scrubber	= 1·323

(Signed) THOS. HORN.

Messrs. Kirkham and Hersey. *Phœnix Gaslight and Coke Company, Office, Greenwich, S.E., Aug.* 12, 1879.

Gentlemen,—In reply to your inquiry, one of your Patent Scrubber-Washers to purify 100,000 cubic feet per hour was put into operation at these works on the 1st of June. At the same moment the whole of our Scrubbers, equal to 28,000 cubic feet, were thrown out of use, leaving your Washer the whole work of freeing the gas from Ammonia. This it has done to perfection up to date. With 10 gallons of water to each ton of coal carbonized passing through it we get a clean test at the seventh chamber, leaving four chambers margin for extra work. The mean quantity of Ammonia in the inlet (fixed and free) obtained from a large number of tests was 241 grains per 100 feet of gas. On the outlet—Free Ammonia—Nil. The quantity of water used is 10 gallons per ton of coal carbonized. The strength of liquor as follows:—

Chamber No.	1	2	3	4	5	6	7	8	9	10	11
Strength of liquor—ounces	Nil.	Nil.	Nil.	Nil.	0·4	1·0	2·2	3·5	5·5	8·25	12·5

We are working five revolutions per minute. It takes out all the free Ammonia, reduces the carbonic acid and sulphuretted hydrogen 30 per cent., requires a very small amount of power to drive, and altogether is, in my opinion, the best machine for the purpose yet invented, and will, I feel confident, ere long, entirely supersede the Scrubbers of to-day. I am glad to find you are going to fix one of these Washers at our Vauxhall works. (Signed) P. J. WATES, Engineer.

For Results and other Testimonials, see next week's Journal.

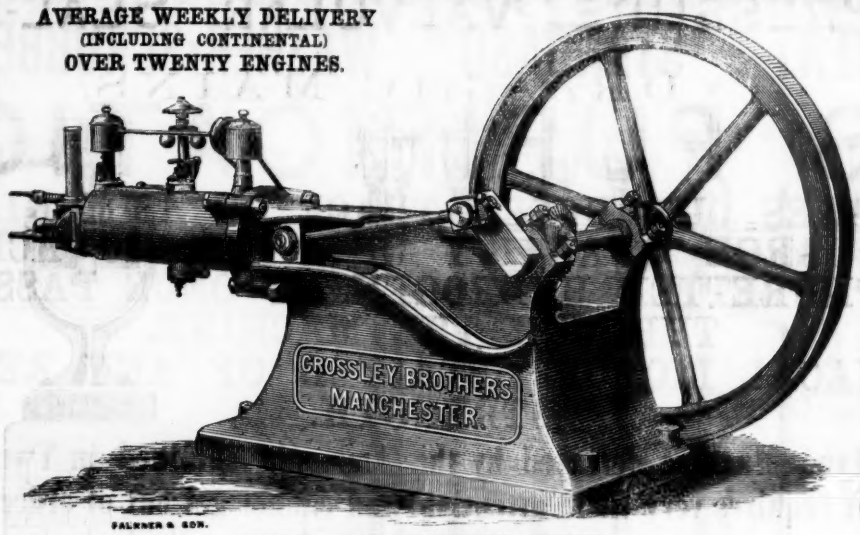
FOR FURTHER PARTICULARS AND TESTIMONIALS, ADDRESS MESSRS.

KIRKHAM, HULETT, & CHANDLER, Limited, { 59 & 60, Palace Chambers, Bridge St. Westminster, London, S.W.

AN ENGINE WHICH WORKS WITHOUT A BOILER OR STEAM

AVERAGE WEEKLY DELIVERY
(INCLUDING CONTINENTAL)
OVER TWENTY ENGINES.

The durability of these Engines is now established by experience, one of them having run night and day at the Hinckley Gas-Works for over Twelve months without any expenditure for repair; this being equal to about 2½ years average work.



Over 2500 already delivered.

Very numerous Testimonials from Users, including Engineers, Men of Science, and others, on application to the makers.

No trouble with Coal, Ashes, Smoke, Insurance, Water, or constant attendance

No Glands to pack, or Water Gauges and Steam Gauges to watch.

STARTS AT A MOMENT'S NOTICE.

THE "OTTO" SILENT GAS-ENGINE.

(Otto and Crossley's Patents, 1876 and 1877,)

THEY ARE USED FOR ALL KINDS OF PURPOSES, CHIEFLY FOR EXHAUSTERS, SCRUBBERS, & PUMPS.

DELIVERED IN MANCHESTER. **SIZES** { NOMINAL HORSE POWER ½ 1 2 3½ 6 8 12 16 / MAXIMUM HORSE POWER ¾ 1½ 2½ 4 9 12 18 24 } **OFFERED.** CASES NOT CHARGED IF RETURNED FREE.

PRICES INCLUDE CAST-IRON STAND, TURNED FLY-WHEEL, AND DRIVING PULLEY; WATER-VESSEL, SEVERAL DUPLICATES, AND GAS-FITTINGS (EXCEPTING METER AND PIPES).

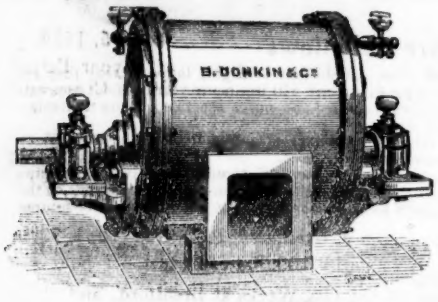
WORKS AND HEAD OFFICES: Gt. Marlbro' St., Gloster St. **CROSSLEY BROTHERS,** MANCHESTER. LONDON HOUSE: 116, Queen Victoria St., E.C

PORTBURY, PATERSON, & CO.,

WET AND DRY GAS-METER MANUFACTURERS.

STATION-METERS, PRESSURE-GAUGES, &c., of the Highest Excellence only.

VICTORIA METER-WORKS, EXETER.



NEW PATENT GAS-EXHAUSTERS.

[J. BEALE'S.]

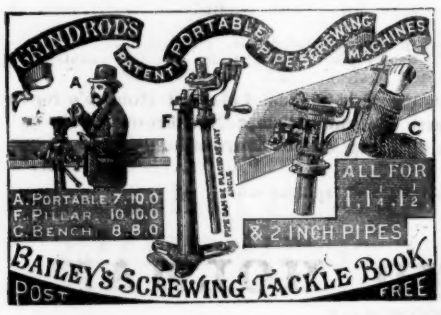
MESSRS. B. DONKIN & Co. possess the sole right to manufacture J. Beale's Exhausters under his new patent.

MADE WITH TWO OUTSIDE BEARINGS AND LATEST IMPROVEMENTS.

ALSO MANUFACTURERS OF

IMPROVED GAS AND WATER VALVES, STEAM-ENGINES, &c., &c.

B. DONKIN & Co., BERMONDSEY, LONDON.



BAILEY'S FLY WHEEL STEAM PUMPS
SIMPLE & STRONG.
WITH NO MYSTERIOUS VALVES.
W.H. BAILEY & Co. HYDRAULIC ENGINEERS.
ALBION WORKS, SALFORD, MANCHESTER.

Prices of Bailey's Double-Acting Steam-Pumps.

No.	Diameter of Steam Cylinder.	Diameter of Pump.	Length of Stroke.	Gallons pr. Hour. Approx.	Price.
	Inches.	Inches.	Inches.	At Slow Speed.	£
A 1	4	2	6	850	18
B 2	6	3	10	1,940	25
C 3	6	4	10	2,000	30
D 4	8	4	10	3,150	40
E 5	6	6	10	7,200	40
F 6	8	6	10	7,200	50
G 7	10	6	12	7,200	60
H 8	8	8	10	14,000	65
I 9	10	8	12	14,000	75
K 10	12	8	15	14,600	90
	10	10	15	21,000	110
	12	10	15	21,000	125

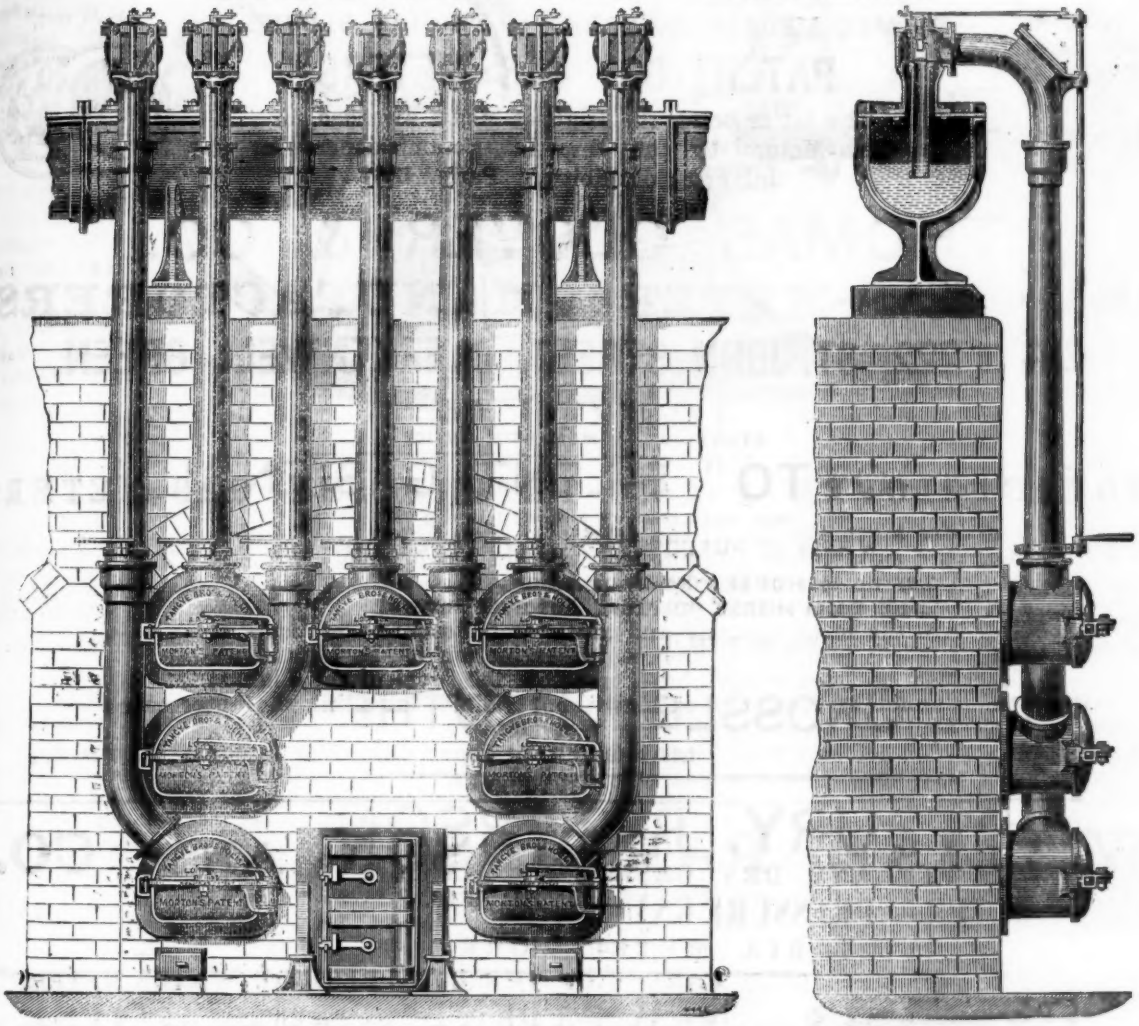
NOTE.—*At quick speed these pumps will generally deliver double the quantity specified.*

BAILEY'S HOT-AIR ENGINES,

From ¼-horse to 4-horse Power. Particulars on application. We also make Hot-Air Pumping Engines, and every description of Hydraulic Work.

W. H. BAILEY & Co., ALBION WORKS, SALFORD, MANCHESTER.

HOLMAN'S PATENT
NON-PRESSURE VALVULAR SEAL-PIPES
FOR
HYDRAULIC MAINS.



The salient features of the above arrangement are as follows:—

1. The Seal is instantaneously opened and closed from the stage by the stokers.
2. There are only two positions for the actuating lever: one when the Seal is opened during the period of carbonization, the other when it is closed for drawing and charging the retort.
3. The retort can never be blocked, because the port directing the gas *through* the Seal is always opened, and the port permitting the gas to *pass* the Seal *direct* into the hydraulic main is also open while the retort is at work.
4. The manager and stokers can always see at a glance, by the position of the lever, whether the retort is duly unsealed while carbonizing its charge.
5. There are no extraneous seals, stuffing-boxes, hinges, screws, chains, pulleys, springs, teeth, or other complication belonging to the valves; they are made plain and strong for rough use, and will last many years without renewal.
6. The valve faces are always covered and never separated, hence no foreign matter can put them out of action.
7. They are positive, reliable, interchangeable, free from all the uncertainty of automatic arrangements, and low in price.
8. No extra pipes or connections are required, because the Valvular Seal-pipe is self-contained in the single branch of the ascension-pipe, which stands on the hydraulic main, and is easily accessible by removing an ordinary cover secured by two bolts only.

(238) TWO HUNDRED AND THIRTY-EIGHT HOLMAN'S PATENT VALVULAR SEAL-PIPES are being fitted to the Hydraulic Mains at the Radford Station of the Corporation Gas-Works at Nottingham.

(84) EIGHTY-FOUR more are being fitted to the Mains in the New Retort-House of the Gas-Works at Brentford, and they can be readily applied to existing Hydraulic Mains generally.

They are to be fitted to the Hydraulic Mains of the New Retort-House at the LONDON GAS-WORKS, and at other large stations.

Mr. MORTON writes in the following terms, under date of Feb. 3, 1880:—

"Gentlemen,—I have determined to use your HOLMAN'S PATENT NON-PRESSURE VALVULAR SEAL-PIPES in our new Retort-House. Will you, in the meantime, send me, as soon as you can, four as you are now making them. I expect to hear of a large demand for these Pipes. I like the idea of always maintaining a passage through an ordinary dip."

ESTIMATES for Retort Work, including Mouthpieces fitted with Morton's Patent Self-Sealing Lids and Holman's Self-Sustaining Cross-Bars and Fastenings, Hydraulic Mains and Ascension-Pipes, fitted with Holman's Patent Non-Pressure Valvular Seal-Pipes complete (as per accompanying illustration), will be forwarded to Engineers on receipt of particulars of intended erections, or re-setting of Retorts during the current or ensuing season.

Engineers preparing Specifications will be furnished with Tracings and all necessary data on application.

Sole Makers:

TANGYE BROTHERS AND HOLMAN,
HYDRAULIC AND GAS ENGINEERS,
CORNWALL HOUSE, QUEEN VICTORIA STREET, LONDON, E.C.

London, 1851 New York. 1853. Paris, 1855. London, 1862.

Dublin, 1865.

The SIX MEDALS AWARDED to THOMAS GLOVER for

PATENT DRY GAS-METERS,

The latter being the Highest Medal awarded for Dry Gas-Meters bv the Imperial Commissioners for the Universal Exhibition, Paris, 1867.

Paris, 1867.

THOMAS GLOVER & CO.,

DRY GAS-METER MANUFACTURERS,

214 TO 222, ST. JOHN STREET, CLERKENWELL GREEN,

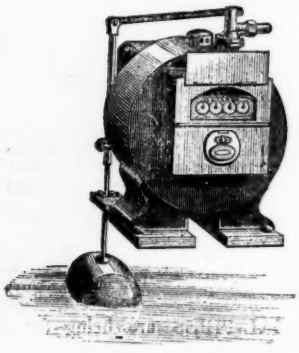
LONDON, E.C.

THOMAS GLOVER & CO.'S PATENT DRY GAS-METERS.

1st, Are a remedy for all the defects of Wet Meters;
2nd, Are suitable for all climates, whether hot or cold;
3rd, Incur no loss of Gas by evaporation;
4th, Cannot become fixed by frost, however severe;
5th, Are the most accurate and unvarying measurers of Gas;
6th, Prevent jumping or unexpected extinction of the Lights;
7th, May be fixed either above or below the level of the Lights;
8th, Cannot be tampered with, without visibly damaging the outer case;
9th, Will last much longer than Wet Meters;
10th, Will not cost more than one-half for repair that Wet or Water Meters do;
Are upheld for five years without charge.

WILLIAM PARKINSON AND CO.

(ESTABLISHED 1816.)



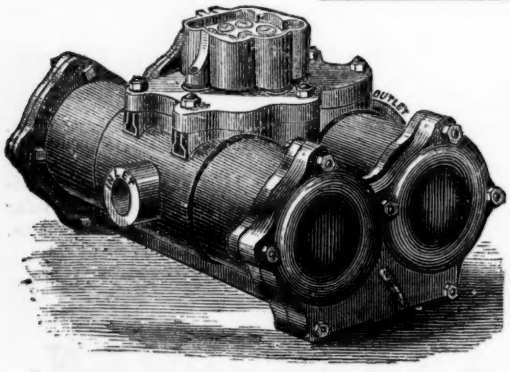
SOLE MAKERS OF THE LOW-PRESSURE WATER-METER.

This Meter will register with perfect accuracy, either at full speed, or with a few drops only passing through it.

It must be placed over the cistern to be supplied, and the water, after being measured, will fall from the outlet into the cistern below.

Each Meter is fitted with a ball-valve, so made that it can be adjusted to shut off the supply at the inlet when the water reaches any required height in the cistern.

The 100-gallon Meter is fitted with a cistern holding about three or four gallons, and may be fixed inside a house, free from the effects of frost, and requires no attention after once being fixed.



HIGH-PRESSURE WATER-METER.

The Union Water-Meter, of which an external view is here given, is of the positive class—*i.e.*, a Meter in which a measuring chamber is alternately filled and emptied, each filling being duly recorded. It is formed of two cylinders, with double pistons in each, having a rotary-valve of peculiar construction, which is worked from cams on the piston-rods.

It is claimed for this Meter, among its advantages over other Piston Meters in use, that it is extremely small and compact, and that its durability and accuracy have been proved by the fact that upwards of 20,000 of them, of various sizes, are in successful operation in the States. In England the instrument has been fully tested by several Water Engineers of eminence, and pronounced by them as a reliable and satisfactory register of water supply; it is also economical in cost.

ALL METERS are TESTED with 60 lbs. pressure before they are sent out.

COTTAGE LANE, CITY ROAD, LONDON, E.C.

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TO CORRESPONDENTS.

FRITH.—*Boil ammoniacal liquor with milk of lime and pass the vapour through five or six waters. The last will be clear and colourless.*

J. G.—*We are much obliged to you for the information in your letter. At present the litigation going on between some of the parties you name precludes our publishing any part of it; but when the legal proceedings come to an end, we shall make use of some, at all events, of the facts you bring to our knowledge.*

No notice can be taken of anonymous communications. Whatever is intended for insertion, must be authenticated by the name and address of the writer; not necessarily for publication, but as a guarantee of good faith.

THE JOURNAL OF GAS LIGHTING,

WATER SUPPLY, & SANITARY IMPROVEMENT.

TUESDAY, MAY 25, 1880.

Circular to Gas Companies.

THE communication which we publish elsewhere from the Gas Engineer to the Leeds Corporation, coupled with the announcement which we are able to make that the South Metropolitan Company have determined to reduce the price of gas in the district of the late Phœnix Company to 3s. per thousand cubic feet from the 30th of June next, form a remarkable commentary upon the observations in our last "Circular" as to the municipal acquisition and conduct of gas-works. As our readers are aware, the scheme for the amalgamation of the South Metropolitan and Phœnix Companies authorized the United Company to continue the price of 3s. 4d. in the Phœnix district for twelve months from the date of amalgamation—that is, until Jan. 1, 1881—without detriment to the dividends of the original South Metropolitan Shareholders. This would retain to the Company some £30,000 of revenue on the year—a sum probably specially welcome just now, as helping to cover the necessarily heavy charges incident to the amalgamation. By conceding the reduction from the earlier date, however, the Directors expedite to the same degree the payment to the holders of South Metropolitan and Phœnix shares an increased dividend of one-half per cent.

The initial price in the Act of the South Metropolitan Company being 3s. 6d. per thousand feet, the price now and for some time past charged in their district—viz., 3s. per thousand—warrants the payment of a dividend of eleven and a half per cent. The proportion of profits paid by the stock of the late Surrey Consumers Company (B) to that of the original South Metropolitan (A), under the scheme for the amalgamation of those two Companies, enabled the latter to share last half year a dividend of eleven and three-quarters per cent., while the former was reduced to eleven per cent. Although the range of equal division of profits was raised in the Phœnix amalgamation scheme to eleven per cent. from ten and three-quarters, at which it stood in that of the Surrey, yet the great increase in the amount of B (contributing) capital, due to the absorption into that class of the whole of the Phœnix shares and stock, will enable the A Shareholders to receive from June next twelve per cent., while the B take eleven and a quarter per cent. Thus the sliding scale asserts itself at once and naturally in its birthplace and congenial home, by inducing the earliest possible reduction of price and increase of dividend, or increase of dividend with reduction of price, whichever way our readers may prefer to put it.

The action of the Directors of the South Metropolitan Company and their chief adviser, Mr. George Livesey, in this matter, is, as we have said, a perfectly natural and proper one. We think it is a particularly happy circumstance that the price is so promptly made uniform throughout the district, and we congratulate Directors, Shareholders, and Consumers alike. At the same time we feel that this prompt reduction points to one serious evil attaching to the present position of legislation on the subject of the sliding scale, and to it we draw the attention of our readers. How does it happen, we ask, that these considerable reductions in price in the districts of the Phœnix and Surrey Consumers Companies are possible *immediately* after amalgamation? The time which has elapsed is not sufficient to have brought about any considerable economies in management or otherwise, and we are forced to the conclusion that the condition of the Companies themselves *before* amalgamation was such as to warrant, if not to require that the price of gas should be reduced. The Phœnix Company, for instance, used not to think that the filling up of the reserve-fund to the very brim should necessarily precede a concession to the consumers, and there can be little doubt in the mind of any one conversant with the character and traditions of the Company that, under ordinary circumstances, the price charged would not have been kept at the price it was. The reason is not far to seek: The Company were under the necessity of applying to Parliament for more capital; with the increased powers they sought they must inevitably accept the sliding scale; the initial price from which the sliding scale operated would be determined by the rate at which gas was actually supplied; therefore it was desirable to keep as high a price as possible, consistently with some regard for appearances and fairness.

The unfortunate departure, in the case of the South Metropolitan Company, from the idea of an uniform initial price, which obtained when the principle of the sliding scale was accepted by the Commercial and Chartered Companies, opened the way to a fight in the case of each Company seeking powers; and the punishing of a well-conducted and successful Company, by giving them a low initial price because their selling price at the time was low, could not but influence largely the action of all those others to whom an application to Parliament was in any degree imminent. Thus the present position of affairs is objectionable on both sides. Companies may well complain if an honest fulfilment of their legitimate duty to their consumers—that of giving them the advantage arising from times of cheap production—is to be used as a scourge when they go to Parliament; and, on the other hand, the consumers have a clear and manifest ground of complaint if the price of gas is being kept up unnecessarily high, so that Companies may make out a better case for a high initial. How this condition of things is to be met is not easy to see. The application of the sliding scale to all statutory Companies alike would answer to *The Times* definition as "heroic" treatment. It would involve probably a laborious inquiry in half the towns in the kingdom, for the chances are that the acceptance of the present selling price as the normal one would be resisted in some cases by the consumers and in others by the Companies. Some way, however, will have to be found to reconcile the present antagonism. For ourselves, we have not professed in the past, and we do not now affect an admiration which we do not feel for the sliding scale. We are old-fashioned enough to retain our preference for the earlier legislation, and to believe and maintain that the true interests of Gas Companies in the long run would have been better served by a faithful and loyal observance of the Gas-

Works Clauses Act of 1847—the details of which might have been modified as occasion required without departing from its general principles—than by the more recent efforts in the way of improvement. We believe that a long life of steady prosperity such as Gas Companies were entitled to expect, would be better than a short period of specially palmy days, followed by the extinction of their business, even on *very good terms;* and this consummation will certainly be hastened by any considerable increase of dividends.

Nothing, in our opinion, is more likely to stimulate the cry in favour of municipal management of gas undertakings than for Companies working under the sliding scale either, on the one hand, to plead or admit that they need the inducement it offers to make them do their duty, or, on the other, without so pleading, to prove the fact by speedy additions to dividends. We admit that it is late now to repeat objections to a principle which has been accepted with general approval by both Municipal Authorities and Gas Companies. What we desire is to point out dangers in connection with it which may be avoided, and especially to urge the desirability of aiding, by every available means, the assimilation or harmonizing of the conditions under which the business is conducted, and the profits of it determined.

In the letter to which we have already referred, Mr. Henry Woodall, of Leeds, courteously draws our attention to what he considers an omission on our part. We have failed not only to give due credit to the Gas Committee of Leeds for their liberal and praiseworthy policy in relation to the consumers, but also to point our often-urged argument in favour of giving to gas consumers the advantages arising from the profits contributed by them, by a reference to the same illustration. We at once admit the fairness of Mr. Woodall's criticism from this point of view, our justification being that we have dealt with a general principle, and not with what he will probably admit to be an exceptional case. The Corporation of Leeds did, in or about the year 1876, see the error of their ways, and turned into what we regard as the path of rectitude. We rejoice over their amendment, and welcome them as penitent prodigals should be welcomed. Having tried a policy of high prices and niggardly expenditure for their first five years, and accumulated debt and dissatisfaction thereby, they have now tried other five years of fair and liberal dealing with their consumers, and the results are in every way encouraging. We offer no grudging congratulations to the Leeds Council and their Gas Engineer. They have done more than any other body to show practically what are the advantages possible to be obtained from municipal management. If one swallow made a summer, our views might be in some danger of being modified by such an example; but until the public virtue of the Leeds Council has secured some imitators, we must continue to deal with the case not from its exceptional but from its general aspect. We think it probable that a continuance of the custom of annually reducing the price of gas will shortly relieve Mr. Woodall from at least one of his embarrassments—viz., that of large and perplexing balances of profit.

Gas affairs at Leeds are conducted by the Council under almost identical conditions to those which would have governed the Companies they bought up, had the latter continued the supply and been compelled to raise their new capital by the means now prescribed—viz., public tender. The auction clauses without the sliding scale take from Companies much of the advantage that used to attach to the constant increase of business; they have to look to the consolidating of the value of their original property as a compensation for its want of growth. The raising of capital in this way, much as we may regret it for some reasons, does, however, take away the argument which Corporations were able to use before the adoption of those clauses—that of their ability to raise money for the carrying on of the business upon much less onerous terms. Without the unwelcome aid of the auction clauses, Companies were well able to hold their own—for reasons, among others, which we gave last week—in conjunction with Corporations. With them there can be no doubt that the comparison which at present is honourably in favour of the older system will not be reversed.

The abstract of accounts of the borough of Rochdale for the past year, which has just been issued, shows that the profits made by the Corporation gas undertaking for this period were £8886, or more than £800 in excess of those of the previous year. Besides this a sum of £1922 has been taken out of revenue in order to pay for new purifying apparatus, which is an arrangement that does not appear to meet with unqualified approval in the town, and may, indeed, be characterized as an inconvenient procedure. The consumption of gas in Rochdale shows a considerable increase over that of the preceding year, the total amount realized being £41,137, as against £40,283 in the previous year; while the working expenses show a general decrease, although wages have risen in the carbonizing department. The expenditure on extensions and alterations, which has been rather large during the past few years, has come to an end for the present, only £681 being charged under this head in the accounts, besides the expenditure on the purifying plant before mentioned. The present value of the works is estimated at £161,780. In face of this satisfactory state of things, it is creditable to a strong body of the members of the Council, having the ex-Mayor at their head, that they sought to reduce the price of gas, and, in fact, succeeded in carrying their proposition by a majority of one; but, unfortunately, when the resolution thus passed was brought up for confirmation a week later, the battle had to be fought over again, and the reduction was negatived by a majority of six. This is rather discouraging; but when the proposal is again brought forward next year, it may be hoped that a greater reduction than the modest threepence per thousand feet now so nearly carried will be found desirable. Sundry members of the Council apparently failed to see the connection between lowness of price and increase of consumption, as they expressed fears lest the loss of revenue which the reduction showed on the basis of the past year's sale would not be recovered by any extension of business that might be expected to ensue. But this consideration was not the sole, or even the principal reason for the rejection of the proposal, the true cause of the hostile vote being a desire on the part of many members of the Council to make the gas profits a source of additional revenue, which was all the more tempting as the Corporation Water Supply has to be largely subsidized from the rates. Taunts levelled by the party of reduction against their opponents, disciples of Mr. John Bright, respecting their practical countenance of the heresies of indirect taxation, as manifested in their willingness to make gas consumers pay an extra portion of the rates, disguised as gas bills, failed to affect the issue, which stands as another instance of the uncertain action of representative bodies.

The Gas Committee of the Middlesbrough Town Council are giving practical effect to their conviction that the depression in trade which has afflicted their town has passed over, by bringing forward a proposal to complete certain extensions of their manufacturing plant which were commenced in 1877, and soon after suspended in consequence of the decrease of consumption which set in towards the close of that year. The supply of gas has been satisfactorily maintained with the old plant up to the present time, but the prospects of the undertaking being the same now, after the interval of diminished production, as they were when the extension was originally contemplated, little opposition to their completion could be made. Although the proposition itself is of local interest, and involves an outlay of about £600 only, the fact of its being brought forward shows the return of a state of things which must give general satisfaction.

The Corporation of Cork City are not altogether satisfied with the provisions of the Bill which is being promoted in the present session of Parliament by the Gas Company, their chief objection being to the initial price which the Company have asked for, although they are quite satisfied with the principle of the sliding scale, with which the Bill will make them acquainted. The dissatisfaction with the proposed price of 4s. 6d. per thousand feet is due to the fact that Mr. G. W. Stevenson, whom the Corporation have called in to advise them in this matter, has stated as his opinion that 3s. 6d. per thousand feet would be quite sufficient to provide for the necessities of the Company. Although not placing implicit faith in any single engineer, the experience which they have had of no less than sixteen engineers, employed by them within the past two years, having taught them caution in this respect, this statement of Mr. Stevenson's has induced the Corporation to join issue with the Gas Company on the question of price, and opposition to the passage of the Bill is consequently threatened, unless the Company give way. An amicable arrangement is hinted at as desirable; but although the Company have fairly stated their own idea as to price, the Corporation, strangely enough, decline to state their views with equal clearness, although the basis upon which those views must have been formed is well known. We should have thought that, under the circumstances, and bearing in mind the dread of costly additions to their already imposing list of professional advisers, which several members of the Corporation expressed when opposition in Parliament was talked of, an understanding between the parties might be as easily brought about before as after a parliamentary conflict.

Arbitration proceedings between the Corporation of Birmingham and the districts of Oldbury and Tipton were resumed last week at the Surveyors Institute, Great George Street, Westminster, before Sir H. A. Hunt, C.B., the Umpire, and Messrs. F. J. Bramwell, C.E., and T. Hawksley, C.E., Arbitrators for the Local Boards and the Corporation respectively, the purpose of the arbitration being to determine, in accordance with the provisions of the Birmingham Corporation Gas Act, 1875, the price to be paid by the districts in question for the distributing apparatus and goodwill of the gas undertaking within the area which they propose to take over, by virtue of a permissive clause in the Act cited. The principle upon which the valuation is to be made was settled by Sir H. A. Hunt in the West Bromwich reference, the award in which case was for £70,750, this sum being the value to the seller (at the date of the service of the notice to purchase) of the subject matter of the purchase to the Staffordshire Company, unenhanced by any advantages resulting from the acquisition of the property by the Birmingham Corporation in 1875. As far as has yet transpired, evidence was taken with the object of ascertaining the value of the mains and distributing plant already in existence, and of the cost of laying an additional main for the separate supply of a certain district, which will be necessarily incurred by the Birmingham Corporation if the two districts are taken away; and also of valuing the free-will, allowing for a prospective increase after the rate of three and a half per cent. While evidence on the last point was being given, Mr. Hawksley remarked that the presence of a reporter was highly objectionable, on the ground that the publication of the evidence before the award was given created local agitation. The reporter accordingly withdrew. Agitation, local or general, is doubtlessly pernicious, and the cause of peace and quietness would be greatly promoted if Mr. Hawksley's opinion were more generally shared by other persons engaged in prosecuting similar inquiries. It might certainly be urged on the other side that the evidence is sometimes more instructive than the judgment; but this, of course, is the bystanders view, and, as such, is not worth consideration.

The Birkenhead Town Council have taken a wise step in deciding to separate the management of their gas and water works, and to appoint a responsible Engineer to take the sole charge of the former. Some opposition was expressed at the meeting of the Council at which the resolution was passed; but, although persevered in to the verge of obstruction, it was eventually overcome. The facts of the case appear to be that the two departments have grown out of the methods of administration which have been in vogue until the present time, and consequently many complaints have arisen, particularly respecting the gas supply. In appointing an Engineer who will be able to put the gas-works on a proper footing, in accordance with modern practice, and keep them up to the increasing requirements of the town, the Council will find that the small increase in salary over that which would be necessary for an inferior official will be an absolute economy in the end, besides being the surest way of making the gas consumers satisfied.

The result of the last year's working of the Liverpool Gas-Fittings Company, Limited, has been highly satisfactory to the Shareholders, and also offers much food for reflection to outsiders. The undertaking is an offshoot of the Liverpool United Gas Company, who used to do a large business in gas-fittings before the disastrous affair of the landing-stage—destroyed by fire caused by the carelessness of a workman, and for which the Gas Company were held responsible—induced the Company to give up a branch of business in which their profits were more restricted than their risk. After this event the Gas Company handed over their fitting business to the newly-formed Limited Company, which was started with a capital of only £10,000 in £1 shares, the dividend upon which, in the fourth year's working, is declared to be ten per cent., with a bonus of one shilling per share, or actually fifteen per cent., free of income-tax. The extent of the Company's business may be inferred from the fact that they paid during the year more than their subscribed capital in salaries and wages alone, while they purchased over £8000 worth of chandeliers and fittings, and closed the year with a stock-in-trade valued at over £4000. We should like to see more of these undertakings fostered by Gas Companies, whose interests would be promoted thereby, without any risk being incurred by the larger body. Of course, in most cases, Gas-Fitting Companies would have to make their own business connection; but although a profit of 15 per cent. in four years is not to be earned everywhere, it should not be difficult in any large town to attract a paying trade to any similar venture, started with a thoroughly good stock, and working in accord with the local Gas Company.

An important exhibition of gas apparatus is to be opened at Glasgow in September next, which is intended by its promoters—the Council of the Philosophical Society of Glasgow—to excel anything of the kind that has yet been held in any town in the kingdom. Awards are to be given to successful exhibitors, and it is therefore to be hoped that the magnitude of the exhibition and the discrimination of the jurors will conjointly operate in making the honours distributed of so much real value as the nature of such things permits. At least, it is to be expected that the second city of the empire will, if matters are properly managed, get together a valuable representative collection of gas apparatus, which will naturally tend to popularize the use of gas among the public of North Britain. Dr. W. Wallace, Dr. Fergus, and Mr. W. Foulis, C.E., are among the originators of the movement in favour of holding the exhibition, and in their hands the conditions necessary to ensure success will not be neglected, and a strong Working Committee has been formed to make preliminary arrangements forthwith.

An interesting paper, of which we give a report in another column, was recently read before the Society of Arts, by Mr. T. Fletcher, of Warrington, "On the Use of Gaseous Fuel, with "Special Reference to its Application to Laboratory Furnaces." Mr. Fletcher fully confirms the statements that have from time to time appeared in the JOURNAL respecting the value of gas as fuel, in a technical sense, and irrespective of its cost, although, as a matter of fact, a comparison between gas, at the usual price at which it is sold in our towns, and solid fuel, for any small or delicate purposes, shows a decided economy to be gained by using the former. Mr. Fletcher speaks with authority on the subject of which he treats, having devoted much labour and skill to the production of a heating burner which should possess certain characteristics of compactness, shortness, and solidity of flame, which he claims to be essential in order to obtain the highest possible duty from the gaseous fuel consumed. He speaks of solid gas-flames eighteen inches in diameter, and of others four feet long, giving heat sufficient for melting cast iron, and by which gold or silver can be refined or porcelain fired with ease, and he highly extols the convenience and rapidity with which the requisite heat can be produced and applied. Mr. Fletcher uses air gas, made by a very simple method of his own devising, as well as coal gas, and this is doubtless convenient enough when the latter cannot be obtained, although the lack of homogeneousness—as it may be called for want of a better term—of a mixture of hydrocarbon vapour with air, as compared with a true gas, gives rise to some curious phenomena. Mr. Fletcher is very severe upon the generality of gas-stoves as at present made and sold, and indicates certain lines for improvements, which would, if properly worked out, tend to enhance the popular appreciation of these useful appliances. No doubt gas boilers and cookers are far from being perfect, and any improvement which Mr. Fletcher can introduce will be a decided benefit to the community. We confess, however, to feeling a little dubious about the possibility of getting such a high duty out of ordinary gas as Mr. Fletcher records as his own experience, when he says that he has boiled a gallon of water with one and a half cubic feet of gas. Now, if the water was at 50° Fahr. when he started, it would take 1620 units of heat to raise it to boiling point, and as the heating power of one and a half cubic feet of common gas, calculated from its constituents, is only about 1050 units, it is evident that Mr. Fletcher's arrangement is a very wonderful one indeed, or his gas must have been of an uncommon kind. We should like to hear more about this system of Mr. Fletcher's.

Some misapprehension having been created by the use of the word "competition" in last week's "Circular to Gas "Companies," in reference to the recent lamp and burner trials at Birmingham, it is right to state that the makers of the various burners experimented with, were not invited to compete (in the ordinary acceptation of the term) by sending in burners suitable for the *special form of lantern* which had been adopted by the Gas Committee for certain parts of the town. The burners were, in fact, purchased in the usual way, for the Gas Committee, and the results arrived at were from private experiments carried out—as Mr. Hunt stated in his remarks at the last meeting of the Midland Association of Gas Managers—under his direction for the information of his Committee. We would lay special stress on the fact that none of the makers of the burners tried had any knowledge of the experiments being conducted, till the results were made known to the public; and this will qualify the meaning of the word used.

Water and Sanitary Notes.

THE Directors of the Lambeth Water-Works Company, in their report to be presented at the meeting of the Proprietors to-day, make the following statement:—"The Directors "are precluded from considering any recommendation for an "increase in the dividend, by reason of the agreement "entered into with Mr. E. J. Smith, under the proposed "Metropolis Water-Works Purchase Bill, 1880, in connection "with which they have nothing further to report." During the half year, more than twelve hundred houses and other supplies, estimated eventually to yield an annual water rental of nearly three thousand pounds, have been connected with the Company's works. The capital account shows an expenditure in the past six months of £31,404, making a total of nearly £1,400,000. The water-rents for the half year were £75,022. The dividend proposed is at the rate of 6½ per cent. per annum, absorbing £37,907, and leaving a balance of nearly £4000 to be carried forward. The share capital is certified at £1,182,860.

A mythical story concerning the Government Auditor of the Metropolitan Water Companies has been going about for some time past, and it is to be regretted that Mr. Allen Stoneham did not see fit to contradict the figment when it first obtained currency. Possibly he thought it was so absurd that nobody would believe it. But nevertheless there are people who do believe it, and among the rest is one who writes in the *Echo*, and calls himself "Father Jean." Discussing the subject of the Metropolitan Water Supply, this authority recently made the following assertion:—"Existing defects in "supply are so notorious that the Government Auditor states, "as a remedy, that competing works, to afford a constant and "ample supply of pure softened spring water, at high pressure, "could be constructed at an outlay of £10,000,000." This preposterous story has its origin in a communication from Mr. Jabez Hogg, which appeared in *The Times* of April 5. By an error in the typographical arrangement, a statement made by Mr. Hogg appeared as a quotation from something put on record by the Government Auditor. Hence Mr. Stoneham has the credit of a statement with regard to the water supply which properly rests with Mr. Jabez Hogg. Where the latter obtained his information we do not know.

The report of the District Auditor in reference to the accounts of the Stockton and Middlesbrough Corporations Joint Water Board, created considerable excitement among the members of that body a short time back, Mr. J. Dodds, M.P., a prominent member of the Board, going so far as to propose a resolution declaring that the Auditor's observations were "alike impertinent, unjustifiable, and in excess of his duties." This was felt to be a little too strong, and the Board went no farther than to declare that the Auditor had exceeded his duties, on which point they desired to give him a reminder, so that he might not transgress again. But when the minutes of the Water Board went before the Town Council of Middlesbrough, the tables were unexpectedly turned, the Corporation being thankful, rather than otherwise, to Mr. Radford, the Auditor in question, for the special feature in his report, on account of the extent to which it enlightened them respecting the "fearful sacrifice" at which the water-works were obtained. Taking this view of the case, the Town Council passed a resolution expressing their dissent from the minutes of the Water Board relative to the Auditor's report, and went on to say that they considered themselves "indebted to that "gentleman" for the revelations which he had made. Such candour is very creditable to the Corporation, and the whole affair reads like a warning history to those fiery opponents of the London Water Companies who have quarrelled so intensely with the Bill of Sir Richard Cross. In reference to the acquisition of the Stockton and Middlesbrough Water-Works by the Municipal Authorities, Mr. Radford said: "It is much to be "regretted that the law and parliamentary proceedings should "have been marked with so much hostility. Had more "pacific counsels prevailed, a great deal of money would have "been saved to the ratepayers." It is, perhaps, a happy thing for the Local Authorities, that their Act "does not "give the Auditor the usual powers of disallowance and "surcharge." The Auditor says, "I can only report;" but he has done so with good effect, and has the satisfaction of finding his outspokenness approved by the chief Local Authority. But it is too late to repair the loss. At the outset, no expenditure is thought too much in fighting a Water Company; but, when the fray is over, there comes an after-reckoning which may possibly prove unpleasant, as in the Stockton and Middlesbrough case.

A visit has been paid to the Aylesbury drainage works by Captain Hildyard, the Assessor to Mr. Harrison, the Inspector who recently held the Local Government Board inquiry into the Lower Thames Valley main drainage scheme. The Assessor was accompanied by several Engineers and others interested in the treatment of sewage. The method now in vogue at Aylesbury, and which has been in operation for some time, is the A. B. C. process of the Native Guano Company. Ten tons per week of "native guano" are manufactured at the Aylesbury works, and sell at £3 10s. per ton. That the process can produce an extremely good effluent, was shown some time ago at Crossness, and proof to the same effect appears to be given at Aylesbury. With reference to the Metropolitan sewage, we observe that General Scott is about to make trial of his cement process at the southern outfall, and there is some prospect of a portion of the northern sewage being applied to irrigation purposes, in accordance with a project in which parliamentary powers are being sought, under the title of the Dagenham and District Farmers Sewage Utilization Bill.

A Committee of the Bolton Corporation having visited several large towns for the purpose of inspecting different methods for the treatment of sewage, have reported in favour of precipitation by lime, as being the cheapest and simplest of the precipitation processes. This is the method which has been in operation at Bolton for several years past, supplemented by charcoal and other ingredients, and the Committee see no reason to adopt any change of material; but new works are to be constructed for the purpose of carrying out the lime process more extensively.

The prize of £100 offered by the Royal Agricultural Society for the best-managed sewage farm utilizing the sewage of not more than twenty thousand people, has been adjudicated jointly to the sewage farm of the Corporation of Belfast, managed by Mr. J. H. Collett, and that of Wrexham, farmed by Lieut.-Colonel Alfred S. Jones, V.C. The £100 prize for farms utilizing the sewage of more than twenty thousand people has been adjudicated to the Earl of Warwick, for the Leamington sewage farm, managed, under the direction of Captain Fosbery, the agent of the Earl of Warwick, by Mr. Tough, the bailiff. A special prize of £25 has also been presented to Mr. R. J. Brundell, for his management of the sewage farm at Doncaster. The mortality among the persons living on sundry sewage farms is said not to exceed three per thousand per annum. At the present time there are about a hundred sewage farms in operation in different parts of the country.

The Society of Arts, silent for a time on the Metropolitan Water Question, enjoys an outlet for its eloquence in another direction. In little more than a fortnight's time the Society will hold its annual "Conference on the Progress of Public "Health," and several matters in which the public are considerably interested appear in the programme. A resolution is to be discussed with reference to the sanitary inspection and classification of dwellings, including a scheme for the granting of "certificates of healthworthiness" in respect of them. It is stated that the conditions and modes of granting these certificates would be analogous to the practice of the department of Lloyd's Association in granting certificates of class and seaworthiness to the mercantile marine. Accordingly, if this system be adopted, we may read of houses being advertised for sale or for letting as "Classed A 1 for twenty years," and so forth. In all cases where people are entering on the occupation of new premises, even in so ordinary a case as hiring furnished apartments for a few weeks, a trustworthy certificate of healthfulness would save much trouble and anxiety, and the fact that such a certificate was not forthcoming might operate as a useful warning. A demand for something which shall answer this purpose seems maturing in the public mind.

DEATH OF PROFESSOR ANSTED.—Last week we announced the death of a gentleman long connected with the JOURNAL, and to-day we record the loss of another of our contributors—David Thomas Ansted, M.A., F.R.S., F.G.S., F.R.G.S., &c., whose death took place on Thursday, the 13th inst. Professor Ansted has, of late, been an almost constant writer for us on water topics; his long, varied, and practical experience entitling him to be looked upon as quite an authority on these matters. He was frequently called as a witness before Parliamentary Committees on Water Bills, where his thorough acquaintance with the subject on which he treated gave great weight to his evidence. He was also the author of several books and essays, prominent among which is his "Water and Water Supply, chiefly in reference to the British Islands," published the year before last. Professor Ansted, who at the time of his death was 66 years old, at one time held a professorship at Cambridge, and was an acceptable lecturer. He was well known at Woodbridge, where he resided; was a magistrate for the county of Essex, and from time to time took his place on the Woodbridge bench.

EFFLUVIUM NUISANCES.

Fourth and Last Article.

The manufacture of salts of ammonia from gas liquor occupied much of Dr. Ballard's attention, especially the production of sulphate, which, being the most common use to which the raw material is put, has attracted much notice from inspectors of nuisances in many parts of the kingdom.

Commencing by a reference to the old process, now generally abandoned, of saturating gas liquor with oil of vitriol in a tank, and then evaporating the solution of sulphate in lead-lined shallow tanks until the crystallized sulphate was obtained—both stages of the process being attended with the evolution of sulphuretted hydrogen, which gave rise to very loud and grievous complaints—Dr. Ballard proceeds to give an account of the various modified methods of manufacture which he has seen in use at the present time. In place of adding sulphuric acid directly to the liquor, the practice now is to distil the liquor with or without the addition of lime, and to saturate sulphuric acid with the ammoniacal vapour thus obtained. In some works the distillation is effected by introducing the liquor into a closed vessel, and heating it either by a fire beneath or by steam, superheated or otherwise. After as much ammonia as can be obtained in this way is taken off, milk of lime is introduced into the boiler, or the liquor is transferred to another boiler for this purpose, and the heating is continued until all or nearly all the contained ammonia is distilled off. The remaining contents of the boiler are then run into a tank or pit where the lime is deposited, while the liquid part either drains away or sinks into the earth. In large works an arrangement on the principle of the Coffey still is in use for distilling the gas liquor by the aid of steam, with or without the use of lime; but Dr. Ballard notes as the best method for using lime, a plan according to which the liquor running from the tower still passes into a boiler supplied with milk of lime and heated by a fire or by steam. The steam from this boiler, containing free ammonia from the distillation of the carbonate, is that which is thrown into the tower, and so there pass off by the exit-pipe at the top of the tower, steam, sulphide of ammonium driven out of the descending liquor, and free ammonia, which pass together to the saturator. Dr. Ballard condemns as wasteful the system adopted at some works of not using any lime.

There are several different forms of saturator. In all of them, however, the two things principally provided for are the complete saturation of the acid, and the carrying off of the liberated gases, the chief of which is sulphuretted hydrogen, in such a manner that they shall not be dangerous to the workmen. One form of saturator consists of a close tank, containing sulphuric acid, in the bottom of which lies a perforated pipe which brings the vapours from the still. The gases are taken off by a pipe from the top of the tank, and are variously disposed of. The vapours are passed in continuously until the acid is saturated, when it is run off to be evaporated, generally in a shallow lead-lined pan, by means of a steam coil. As the liquor evaporates, the sulphate becomes deposited in a crystalline form. Offensive steam is given off during the evaporation. Another form of saturator consists of a tank similar to the preceding example, but not completely closed, to which, as the contained acid becomes saturated, frequent additions of strong sulphuric acid are made through a funnel. The evolved gas is drawn off by a fan, or chimney draught. In this case as the solution becomes supersaturated with sulphate the salt falls in crystals, which are drawn out, when thought proper, into another tank, where the crystallization is completed on cooling, the mother liquor which drains off being returned to the saturator for another operation. Another form of saturator is that commonly termed a "fishing-box." It consists of a lead-lined vessel divided into two compartments by a vertical curtain of lead, which does not touch the bottom, but seals itself in the contained liquor. One of these compartments has lower sides than the other, and is open at the top. The other compartment is close, except that it has a pipe in the top to carry off the liberated gases. The perforated vapour-pipe from the still passes to the bottom of the closed compartment. Strong acid is added from time to time as required. The sulphate falls as it is formed, and is ladled out from the open compartment. This is, in Dr. Ballard's opinion, the best form of saturator for preventing the escape of offensive gases into the atmosphere of the works. The pipe which carries the gases off is sometimes taken through a tank of liquor to warm it, or beneath the drying-floor on which the sulphate is laid to drain, and thus a portion of the waste heat is utilized.

Sulphate of ammonia works, when badly designed or carelessly managed, are a most intolerable nuisance, in consequence of the sulphuretted hydrogen mixed with some other offensive hydrocarbons which are evolved in the processes carried on therein. Medical men and the public generally have much dread of the effects of the nuisance on health, in which, however, Dr. Ballard does not bear them out, as he gives a list of the effects commonly observable therefrom, which differ in no essential particular from those due, in his opinion, to the operation of almost any offensive smell.

The sources of nuisance from such works as these may be one or more of the following, viz.:—(1) The reception, transference or storeage of the ammoniacal liquor. (2) The escape of offensive gases and vapours in consequence of leakages about the apparatus. (3) Insufficient precautions in disposing of the waste liquor and lime discharged from the still. If these waste matters are discharged while hot, which is customary, the vapours that arise are offensive. If the hot waste is allowed to run into the sewers, nuisance is certain to arise, as was the case recently at Battersea. (4) The discharge of the offensive gases and vapours from the saturator into the air, which forms the most ordinary of the sources of nuisance from sulphate of ammonia works. (5) The evolution of offensive vapours when the whole contents of a saturator are drawn out into an open tank to cool. (6) The evaporating down of the solution drawn from the saturator, when strong acid is not used.

As to the remedies for these several sources of nuisance, they may be enumerated as follows:—(1) The gas liquor should be kept from exposure to air, by using every available means of covering it while in transit from the gas-works to the place of manufacture, and by keeping the opening of the storeage-tank guarded with a purifying-box supplied with hydrated peroxide of iron. (2) Care should be taken that all parts of the apparatus are in good condition and gas-tight. (3) For the prevention of nuisance during the running off of the waste matters from the still, the most important point is that they should be thoroughly exhausted of ammonia. By careful working, the percentage of ammonia remaining may be reduced to about 0·002. The hot waste from the still should always be taken off through a pipe into a close receptacle for deposition of the lime, if any be used, ventilation being provided for by a pipe of sufficient length to condense vaporous matters rising through it. The liquid portion should never, until quite cold, be discharged into a sewer with which house-drains communicate. The removal of the lime deposit should be effected expeditiously, with careful guarding against unnecessary exposure, and covered with earth if deposited in a heap. (4) The liberated gases should either be conducted into a tall chimney-shaft, or should be thoroughly burnt, after having been completely condensed and dried. The burning may, however, result in the production of a fresh nuisance by the formation of sulphurous acid, while the condensed matters are offensive, unless great care be taken to get them cool enough before allowing them to run away. Hence, instead of burning the gases, they may be arrested by oxide of iron purifiers, into which they may be driven by a steam-jet exhauster. The oxide of iron may, of course, be revivified in the same way as for gas purification. (5) Nuisance from the fifth source mentioned may be prevented by keeping the cooling-tank covered so long as its contents remain hot enough to give off offensive vapours. (6) During the evaporation of the sulphate solution, steam should be driven through the saturator for 20 minutes or half an hour, after shutting off the ammoniacal liquor, the steam being carried off and condensed in the usual way. This will obviate the nuisance which might otherwise arise.

We may note, in concluding this part of our comments, that all these preventive measures are in operation at one or another of the establishments which Dr. Ballard has visited, and should therefore be readily adopted by other manufacturers who are liable to receive complaints of nuisance from any of the sources to which they refer.

When sal-ammoniac is manufactured from gas liquor by direct decomposition with hydrochloric acid, two methods are in use. By one method the gas liquor is introduced into a tank or vat, either open or partially covered, and hydrochloric acid is run in gradually until saturation is complete; or a system of saturation by ammoniacal vapour, evolved with or without the use of lime, is pursued after the plan previously described for the manufacture of sulphate. The cooling and crystallizing out of the chloride is also done in a similar way as for sulphate. The crude crystals are used in the process of galvanizing iron, but for the production of commercial sal-ammoniac a further process is necessary, which consists in baking the crystals, either in a layer on an open platform, or in a close oven, in which a process of sublimation is carried on. The manufacture of this product is apt to cause great nuisance, even more than in the manufacture of sulphate, unless great care is observed in all the operations involved; yet it is quite possible to conduct it in such a manner that no offence may be caused, by the adoption of similar precautions as before mentioned for sulphate-making. In any case, the method of distillation is to be preferred to that of direct saturation of the crude liquor.

The distillation of tar is another important department of industry which Dr. Ballard has passed under review. The processes carried on at tar-works consist in the distillation of crude coal tar, and in addition, at many large establishments, the subsequent treatment of the distillates for the preparation of benzole, crude carbolic acid, &c., and of crude anthracene. The coal tar, mixed with more or less ammoniacal liquor, is distilled in large iron stills, each of which may contain from 6 tons to 20 or 30 tons, heated from beneath by coal or "dead oil." The products of distillation, after having been condensed, are collected separately, the distillation being fractional. The light oils, which contain benzole and solvent naphtha, first come over, followed by the heavy or creosote oils, which are usually run off in two portions, the first being carbolic oil. Naphthaline also comes over at this stage of the distillation. Then anthracene oil is collected last of all, the remaining contents of the still being pitch. Up to the time of the collection of the anthracene oil no appreciable quantity of permanent gas comes off; but in this last stage, owing to the high temperature—200° to 300° C.—permanent gases are formed, consisting of about two-thirds carburetted hydrogen and one-third sulphuretted hydrogen. In England all the operations of distillation are performed in one still, but in Scotland two stills are used. In the best works the first distillation is effected by throwing in free steam, and the products are all condensed together. The resultant water containing ammonia and the light oils, which are separated by drawing off the former from the bottom and the latter from the top of the receiver. The material left in the still is known as "boiled tar," which is subsequently transferred to other stills for treatment by fire heat for the heavy oils. The tar made at the Scotch gas-works contains but little anthracene or carbolic oil, and the heavy oil is usually sent away at once for pickling timber, and the pitch is used for making asphalte, or for artificial fuel.

Dr. Ballard accords much praise to the arrangements of Messrs.

George Millar and Co.'s tar-works, at Dalmarnock, Glasgow, which he holds up as a model establishment for neatness and complete freedom from offence. At these works plain cylindrical boilers, fired from beneath, are used instead of the usual spherical still, and the charging and discharging of the tar and pitch are conducted in close pipes or conduits. The pitch, after being run out from the still, is allowed to cool in separate chambers before being put into tubs or run into a bay to solidify. The anthracene oil is left to stand, when a solid crystalline deposit of crude anthracene is formed. This crude deposit is separated from the oil by straining, and is then pressed. The other oils are subjected to various processes of redistillation and rectification, for obtaining from them such substances as benzole, solvent naphtha, carbolic acid, &c., which generally form separate trades.

The effluvia from tar-works are sometimes a very considerable nuisance, not only in their immediate neighbourhood, but even at a distance of half a mile or more. The vapours from hot pitch will travel, as a compact white cloud, near the surface of the ground, to great distances, and their pungent, irritating effects are well known, and to many persons they are intensely disagreeable. The only ill effect upon health that Dr. Ballard has heard of is, however, that they sometimes produce headache, giddiness, faintness, nausea, and perhaps some oppression of the breathing, but never anything very serious, or any permanent ill effects.

The ordinary sources from which nuisance may proceed are the following:—(1) Offensive odour of sulphide of ammonium proceeding from the tar when it is received in open barges, and is in course of transference to the store-tanks. (2) The escape into the atmosphere of offensive uncondensed and non-condensable products of distillation. (3) The escape of the vapours of hot pitch. (4) The combustion of creosote oil as fuel for the stills, when the arrangements are defective.

The remedies for these nuisances are briefly as follows:—(1) The tar should always be kept carefully covered, as prescribed for gas-works. (2) The nuisance arising from the discharge of offensive gases and vapours during distillation is to be obviated by the adoption of means to collect these gases, condense such as are condensable, and burn such as are combustible, or otherwise to deal with them chemically. The most perfect means of doing this which Dr. Ballard has observed are those in operation at Messrs. Burt, Boulton, and Haywood's works at Silvertown. From each condenser the condensed and uncondensed matters pass into a receiver having an opening at the top, which, during working, is firmly closed with a faced iron lid. Out of this receiver the condensed liquids are drawn off below to the store-tanks, while the uncondensed gases and vapours are drawn off above by an exhauster. The gases and vapours from all these receivers are taken off by one exhaust main which leads into two washers, the first arranged on the principle of a Woulffe bottle. After this the gases pass through a third condenser or washer, shaped like a long cylindrical boiler, partly filled with water, through and over which they pass to the outlet-pipe, which terminates in a furnace where this uncondensed portion is consumed. Besides the prevention of nuisance, this exhausting apparatus is profitable in working, according to the manufacturers statements. (3) The nuisance arising from the pitch vapours can be much controlled by the proper use of the cooling-oven for pitch after it leaves the still, and its consequent emission into the bays only when it is cooled below the point at which vapours can be disengaged. Due retention of the pitch in the cooling-oven is also advantageous to the manufacturers, by the ensuing retention of creosote oils and their incorporation into the body of the pitch, thereby softening it. At many large works the pitch bays are also enclosed. (4) When creosote oils are used as fuel, proper appliances can and should be obtained for their combustion without smoke.

The manufacture of carbolic acid is carried on at the Beckton Gas-Works and at many tar distilleries. The carbolic oil obtained by the distillation of tar, as before mentioned, is the source from which it is obtained. Carbolic oil contains carbolic and cresylic acids mixed with other light and heavy oils in varying proportions, and the first process is designed to separate them from these oils. The carbolic oil is first treated in an iron tank with caustic soda, which dissolves out the carbolic and cresylic acids. The solution is syphoned out into an open lead-lined tank, when sulphuric acid is added. This combines with the soda, and causes the separation of the crude carbolic acid, which is then ladled or syphoned off. The remaining mixture of light and heavy oils is of value, and is subsequently distilled fractionally for the preparation of benzole, &c. The solution of sulphate of soda from the acid tank is thrown away. Carbolic and cresylic acids are prepared from the crude acid by a series of fractional distillations and crystallizations. The residue of the first distillation, which ought to be conducted to dryness, is a light spongy coke, used as fuel. In subsequent distillations an acid comes over which solidifies at a higher temperature than that which results from the first distillation. The products of condensation are collected in numerous small fractions, and are usually received in a series of galvanized iron vessels. When the receivers are cooled, the carbolic acid crystallizes, while the cresylic acid holding some carbolic acid in solution remains liquid. Various subsequent operations are carried on with the object of further refining the acids.

The nuisance caused by the above-described processes chiefly consists of the escape of offensive gases towards the end of those distillations when a coke is produced. This may be avoided by condensing and washing the gases, consuming the non-condensable remainder in a furnace as in former examples.

It is scarcely necessary to enter here into the details of the manufacture of the other products of coal tar, such as benzole, aniline, &c., which are more or less exclusively chemical businesses, and only very distantly connected with gas-works. Suffice it to say that they are to be found fully discussed in Dr. Ballard's report. With one more notice of a particular trade process intimately connected with the manufacture of gas, this series of articles will terminate. The preparation of "ammonia material" for gas-works consists in the saturation of wood sawdust with sulphuric acid, for the production of a material used at some few gas-works for the separation of ammonia from the crude gas. After the material has been used at the works, it is taken back and subjected to other processes, either for the separation from it of the sulphate of ammonia it then contains, or in order to prepare it in some other way for use by the manufacturers of artificial manures. The sawdust is, in the first place, caused to pass through a covered channel in which a screw works and moves the sawdust into the place where it is stored. As the sawdust passes through the channel, it receives upon it a little stream of sulphuric acid, which blackens it, causing the evolution of acid fumes, consisting of sulphurous and acetic acid. These fumes, being offensive, must be washed and passed into a chimney to finally dispose of them. The material, as it is returned from the gas-works, may contain as much as 50 per cent. of sulphate of ammonia, and from 5 to 10 per cent. of sulphocyanide of ammonium. The material is then baked to drive off the offensive hydrocarbons which it contains, and is afterwards disposed of to the manure manufacturers, who treat it in the ordinary way. When the hydrocarbon gases are drawn off and consumed in a furnace, no appreciable nuisance is caused by the process.

Communicated Article.

EFFECT OF TEMPERATURE IN THE GAS AND AIR SUPPLY UPON THE ILLUMINATING POWER OF GAS-FLAMES.

By Mr. R. H. Patterson, F.S.S.

THIRD AND LAST PART.

The experiments made at Munich relative to the effect of the temperature of gas at the point of ignition upon the illuminating power of its flame, were carried both upwards and downwards from the ordinary temperature. As previously described, in my experiments in 1871 I found no difference in the illuminating power of the gas when supplied to the burner at the highest temperature employed at Munich, namely—212° and 288° Fahr. We come now to

THE EFFECTS OF COOLING THE GAS.

The results of cooling the gas below the ordinary temperature at Munich were as follows:—When the U-tube was immersed in snow, so as to bring the temperature of the gas down to 32° Fahr., the illuminating power was found to have fallen from 100 down to a point varying from 75 to 86; in other words, the light was reduced, on the average, to the extent of 20 per cent; and when the temperature of the gas was still further lowered by immersing the U-tube in a mixture of salt and ice (temperature 4° below zero), the illuminating power of the gas-flame was reduced by nearly two-thirds, ranging from 33 to 40, as against its ordinary illuminating power of 100.

The latter temperature (– 4° Fahr.) is one to which, in this country, the gas, as supplied to the public, is hardly ever subjected; and although I contemplated doing so, I did not carry the application of cold to this extent. But as regards gas at the freezing point (32° Fahr.), my experiments were made in a very stringent manner; for the gas at this low temperature was tried against gas at the highest temperature employed at Munich. By means of a bye-pass, gas at the freezing point and the same gas at a temperature of 296° Fahr. were supplied alternately to the burner, but without making the slightest difference in the readings of the photometer. The photometer was observed most carefully both myself and by Mr. W. Thompson, and we could not see the slightest difference.

Now, in this case I had expected a different result; not, however, of a kind affecting the real question at issue—viz., the effect of temperature in the gas upon the illuminating power of its flame—but owing to a change in the constitution of the gas itself, which is quite a different matter. Just as a very high heat alters the composition of gas, greatly diminishing its illuminating power, so will extreme cold, from a kindred cause, produce a similar result. In the former case, there is a disintegrating chemical effect produced by excessive heat, occasioning, *inter alia*, a deposit of carbon; in the latter, there is the effect of freezing, by which the water contained in gas in the form of aqueous vapour is separated from the gas in the form of ice, and a portion of the illuminating hydrocarbons are condensed along with it. Neither of these circumstances properly enters into the question as to the effect of temperature at the point of ignition upon the illuminating power of the flame. Nevertheless I had expected that the freezing temperature would have produced a loss of illuminating substance in the gas; and the fact that this did not occur was doubtless owing to the very brief time (possibly not above a moment) that the gas was subjected to the cold. The temperature of 32°, or even a little lower, was fully imparted to the gas, but only for an instant before the gas sprang into flame at the point of ignition.

When results are obtained so discordant as those at Munich and in my own experiments, in which I had the valuable co-operation of Mr. W. Thompson, the position of the case is by no means satisfactory. As regards the heating of the gas, the discordance is not very great; for at Munich, with gas at 212° Fahr., the increase in illuminating power was only 4 per cent., and at 288° Fahr. the increase was 18 per cent. But the discordance when the gas was cooled below the ordinary temperature is very striking; for when the gas

was reduced to 32° Fahr. at Munich, the loss of illuminating power, compared with gas at the ordinary temperature, was from 75 to 86—average 20 per cent.; whereas in my own experiments, when gas at 32° Fahr. was tried against the same gas at 296° Fahr., the disc of the photometer showed no change.

As already stated, I think there can be no question (supposing, of course, that the composition of the gas itself undergoes no change by deposit of illuminating substance) the hotter the gas at the point of ignition the more favourable will its temperature be to effective combustion; and that the lower its temperature the less favourable will it be to intensity of combustion. But the practical point is, is this *tendency* in either case of any appreciable effect? My own experiments showed that it had none. And in the first part of this paper I stated considerations which appear to me to be sufficient to explain the fact as I found it—viz., the ready or instantaneous combustibility of coal gas, whereby the slightest spark of fire at once raises gas to a temperature above 3000° Fahr. In the face of such a temperature in a gas-flame, what effect can be expected from a mere raising of the temperature of the unignited gas from 65° to short of 300° Fahr., or from reducing the temperature from 65° to 32° Fahr.? With such reasonable considerations to support them, I believe in the trustworthiness of the results obtained in my experiments; whereas, without such corroborative considerations, I should not have relied upon them with any confidence in the face of the experiments made at Munich.

The explanation of the great decrease of illuminating power found at Munich when the gas temperature was reduced to 32° Fahr., probably is not the effect of that temperature in the gas upon the combustion and brilliancy of the flame—which is the point at issue—but the loss of illuminating substance in the gas owing to the freezing and deposit of its moisture, which is never condensed by itself, but always along with some portion of the illuminating hydrocarbons.

There is one other point that deserves to be mentioned, although I cannot venture to rate its degree of importance. It is this: We do not know the precise shape and structure of the burner employed in the Munich experiments, but we do know now-a-days, and very clearly, how greatly the illuminating power of gas is affected by the burner. A really good burner—and more or less every burner—does most justice to the gas when the gas is consumed at a particular quantity, in volume, as well as quality. And the *volume* of the gas issuing from the burner would of necessity vary according to its temperature—contracting or expanding in proportion as the temperature is lowered or raised. The same effects, of course, occurred in my own experiments; but whether the different burner employed at Munich had anything to do with the different results then obtained, I cannot say. I hardly think it did; but it is well to state the point.

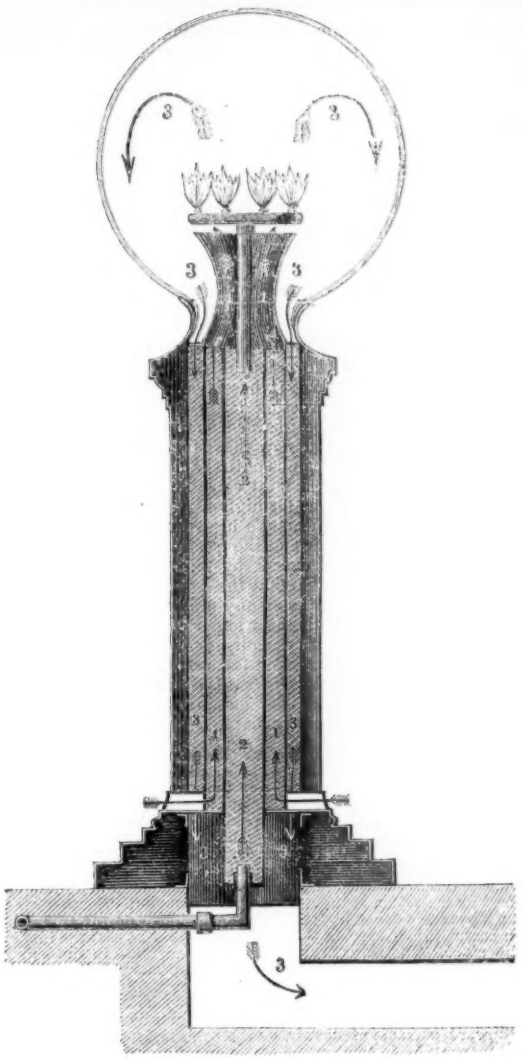
Heating both the Gas and the Air.

We now come to Herr Siemens's experiments, described in the Journal for Jan. 13 [see *ante*, p. 60], in which both the gas and the air were heated.

The competition of the electric light, which has given such an impetus to improvements in gas illumination, furnished the motive for these recent experiments by Herr Siemens; but he mentions that he first turned his attention to the subject some 20 years ago, when the advantage of heat-regenerating furnaces became demonstrated; the "hot-blast," which has the same principle, being, of course, of much earlier date. Herr Siemens's first experiments were confined to heating the air supply, and they were so unsuccessful that he deemed his object impossible of attainment. These early experiments were made in the same manner as the Rev. Mr. Bowditch's—namely, by using a double chimney for the Argand, and thereby heating the air before it reached the gas-flame in the inner chimney. Herr Siemens's explanation of his failure is that the heat to which the chimney of the Argand was exposed was so great as to destroy it. But if, as stated by Dr. Letheby, the heat which can thus be imparted to the chimney without necessarily destroying it be as high as 600° Fahr., we should have expected Herr Siemens not to have so readily abandoned his experiments; at least, if he succeeded in obtaining an increase of fully 60 per cent. in the illuminating power of the gas, as was stated by Dr. Letheby.

Subsequently, as his experience of regenerative gas-furnaces was increased, Herr Siemens came to see that a double chimney, or such-like apparatus, was unnecessary, and (he says) actually disadvantageous; and that he could attain his object simply by making use of the *natural currents* of gas and heated air—"by taking advantage of the automatic motion of gas, air, and the products of combustion at different temperatures." Herr Siemens gives diagrams of several different kinds of apparatus for applying this principle; but it will be sufficient here to deal with the principal and apparently the best form of it, appending his description of it.

Variety A is a pillar lamp, which, as may be seen by the drawing, consists of three concentric tubes, surmounted by a glass globe. At the lower part of the globe is an ordinary burner, with six radial flames. All the space in the tubes is filled with wire netting, which I call regenerators, and which serve either to abstract heat from passing gases, or to communicate heat to them. The middle pipe being the gas supply, the air is admitted from below into the second annular pipe, and, passing upwards into the globe, is there burnt with the gas. The products of this combustion pass away down through the annular space of the outermost pipe, into a chimney or aspirator flue. (The arrangement and course of the currents are shown in the drawing.) The wire net regenerators, in the annular space of the outer pipe, are thus heated by the products of combustion as they pass away from the globe, and this effect is specially marked in the upper part of the wirework. The heat thus extracted is communicated by conduction and radiation to the regenerators in the air-pipe, and also through the side to the inside gas-pipe. Air and gas are thus pre-heated, and this pre-heating increases in proportion as the temperature of the flame, increased by the pre-heating of air and gas, increases the temperature of the regenerators in the outer pipe. The increase of



Siemens's Lamp, Variety A.

temperature, and consequently of the illuminating power of the flame in the globe, continues until the cooling effect of radiation balances the production of heat.

In short, Herr Siemens places a burner (or several burners) on the top of a pillar consisting of three concentric tubes, all of which are filled with wire gauze, in order to convey heat from the surface of the tubes through the gas and air, intimate contact being indispensable for heating the gas. The central tube conveys the gas to the burners; the next, or middle tube, contains the air supply; and the outermost tube conveys away the products of combustion, which, being at a very high temperature in their downward passage, heat the air and the gas in the two inner tubes. The gas-tube, of course, is carried quite up to the burner, and the air-tube has its outlet close to and immediately beneath the burner; but the top of the outermost tube is a good way below the burner, in order that the products of combustion may descend to it without coming in contact with the air supply and the burning gas.

This is a most ingenious and economical means of heating the air, and in a less degree the gas. But the remarkable thing is, that the products of combustion can in this manner be carried off without damaging the combustion of the flame. It seems almost inconceivable that the products of combustion—the exceedingly hot vapour into which the gas-flame is resolved—should, upon reaching the top of the lantern, *immediately* turn downward, and, descending around the sides of the lantern, pass freely away down the tube into the open air. No doubt the products of combustion (CO_2) are twice as heavy as common air, and would take such a course if they were cool; but in this case they are in their very hottest and lightest state; and I think the general expectation would have been that, in this lantern of Herr Siemens, the products of combustion would refuse to descend at once, and would linger in the upper part, or indeed all through the lantern, thereby impeding combustion. Of course, if an "exhaust" were employed upon the outermost tube, by which the hot products of combustion are withdrawn from the lantern, the successful working of Herr Siemens's lantern would be readily intelligible; but Herr Siemens makes no mention of an exhaust, and also he states that he relies solely upon the "natural currents." If this be so—and it cannot be doubted after Herr Siemens's statement to that effect—what Herr Siemens has thus accomplished appears to me most valuable, as an example, with reference to the construction of gas-lanterns generally. The obvious inference from Herr Siemens's apparatus is, that it is not necessary to have any outlet at the top for the issue of

the products of combustion; and, accordingly, these hot vapours in their downward course become entirely available for heating the air and gas.

Mr. Sugg, in his lantern patented last year, may be said to have demonstrated a kindred fact (old enough, it is true, as regards oil-lamps)—namely, that it is not necessary to have an inlet at the bottom for the supply of fresh air. It will be seen that both Mr. Sugg's and Herr Siemens's arrangements depend upon the natural or automatic currents of fresh air and the products of combustion, at the different temperatures which they necessarily possess. Mr. Sugg makes his air supply descend around (and without impinging upon) the upward current of the products of combustion, which escape as usual from the top of the lantern; Herr Siemens makes the products of combustion descend around (and without impinging upon) the fresh air and burning gas. Mr. Sugg, in fact, closes the bottom of the lantern, and Herr Siemens closes the top. The former of these arrangements is perfectly intelligible; but, *à priori*, I should have been incredulous as to the practical possibility of the latter. As regards Mr. Sugg's lantern, it has always seemed to me that the greatest difficulty in constructing large gas-burners—or at least the defect which has most to be guarded against—is the strong upward rush of air from *below;* and now that Mr. Sugg has proved that the bottom of the gas-lantern can be entirely closed, and the air admitted downwards from the top, a most valuable onward step has been accomplished in the use of gas for high degrees of illumination.

The economy of Herr Siemens's heat-regenerative gas-lamps consists in heating both the air and the gas by means of the products of combustion; and, further, except by the means which he has employed, it appears impossible that the heat can be applied so close to the point of ignition as to be of any use; for the air, and still more the gas, very quickly lose the heat imparted to them, especially when they are in the small quantity requisite for gas-lamps.

The most novel and interesting feature of Herr Siemens's lamp lies in its fundamental principle—viz., the utilization of the natural currents within the lamp. Therefore I shall quote the explanation which the inventor gives of the matter:—

> It is necessary to explain the fact that the highly-heated products of combustion, rising upwards in the globe, turn therein and pass away downwards, without affecting the flame or the air supply. This is explained by the rising flame taking the hottest passage in the middle of the globe, while the combustion products, in passing off, naturally take the coolest way, along the inner surface of the globe. . . . In variety A, the flame and its products rise straight upwards, the gases produced being hot, and of small specific gravity. At the top of the globe they encounter a natural obstacle and turn downwards, unless this movement has been previously induced by the action of the draught. As, however, the hot gases or combustion products have little inclination to move downwards, they will, when compelled to do so, take the coolest way—viz., past the inner surface of the globe. The upward and downward currents in the ball keep as widely separated from each other as possible. The peculiar effects of the automatic currents are also shown quite as favourably in the regenerators of variety A. The downward currents of the hot combustion products always take the coolest way, their specific gravity being greatest there. The upward currents of hot air, on the contrary, take the hottest course. The consequence is that regenerators are always uniformly heated in horizontal layers. The stream moving downwards, as well as the one moving upwards, always tends to keep as near as possible to the surface of the pipe by which they are separated, because directly on the surface of this pipe is to be found the heating influence for the rising current, and the cooling influence for the downward current. With this arrangement the exchange of heat is, therefore, as complete as possible.

Herr Siemens has not ascertained what is the temperature which the flame thus attains. Of course, the sole cause of the increase of light is the increased intensity of the flame, or the gas combustion; and the heat must be a sore trial to the glass globes. Herr Siemens says: "Although only the flame, not the products of combustion, *radiates* heat [that is, imparts heat without actual contact], yet the glass is made very hot, and is easily cracked. To avoid this, I harden the glass so as almost to entirely overcome its tendency to fracture." This statement suggests a remark relative to his early and abortive experiments in heating the air supply by means of an Argand with a double chimney. He states (as I understand him) that he found success impossible in those early experiments, owing to the inability of the glass to withstand the high heat. Now, while fully admitting that his present apparatus is far more ingenious, and also much more efficient for its purpose, than the double Argand, although much less simple and readily available, the question arises, Could not the glass of the Argand, by his annealing process, be made to resist fracture equally with his new globes? If not, this must be owing, partly at least, to the temperature *within* being greater in the case of the double Argand than in his present globe. But if the internal temperature in the former case be higher than that in the latter, the intensity of the flame in the Argand should likewise be greater, and the amount of light also greater. No doubt it is probable that, owing to the larger size of Herr Siemens's globe, the glass is less directly affected by the radiating heat from the flame. On the other hand, since the highly heated gases of combustion are retained in his globe, while they escape from the Argand, all the heat except that *radiated* by the flame should be less in the latter than in the former.

Herr Siemens states the temperature of an ordinary gas-flame to be 1600° C., and he conjecturally estimates the temperature of the electric light at 1800° C.—these figures being equivalent respectively to 2353° and 3272° Fahr., and he says that another 100° C. added to the temperature of the gas-flame "would make a very great difference in the illuminating power." This is a very reasonable inference; but Herr Siemens has not yet ascertained whether the fact is actually so.

I may remark that 1600° C. (although probably correct) is a lower temperature for a gas-flame than might be inferred from the statements of some other authorities. Some authorities state the temperature of the Bunsen burner at 1800° C. (3272° Fahr.); and in experiments which I have made, by melting metal wire in the flames, I found that a gas-flame possessed a higher temperature than that of the Bunsen burner—I sometimes succeeded in melting a piece of platinum wire in a flat-flame burner (and the heat of an Argand is probably higher), although I failed to do this in a Bunsen flame. This result appears to me to be partially supported by the fact that in the Bunsen burner the gas is largely intermingled with air; and although this circumstance will certainly give an intimate supply of oxygen to the gas-stream, it will also throw into the body of the flame a large quantity of incombustible nitrogen, which, by becoming equally heated with the flame, will tend to cool it by absorbing heat from the burning gas. But the general opinion is quite the other way; and, so far as I see, the facts of the case have to be ascertained as well as explained.

The Increase of Light.

The last and most important point is the increase of light which is obtained from the heating of the air and gas in Herr Siemens's lamp. The claim which he urges upon this point may well make the reader stand aghast. He says: "As regards the intensity of the light, I can safely state that it is at least *six times greater* than in ordinary gas-burners; but the exact determination of this I leave to more skilled observers. I may, however, point out that the power of the light at present produced is no criterion of the future development of my system, since the apparatus is still incomplete, and the intensity will be found to vary in different arrangements." An increase of 600 per cent. from heating the gas and air! and a further increase expected by-and-by! Herr Siemens feels confident that the increase of light from the gas is sixfold, but he does not say that he submitted his lamp to testings for illuminating power. And until this is done, I for one positively decline to believe in the result here claimed. As previously pointed out, even the 67 per cent. of increase shown by Dr. Letheby's experiments rested upon only one complete testing. But what is 67 per cent. to "at least" 600 per cent.? It is also a warning fact that Dr. Letheby obtained no increase of illuminating power when operating upon common gas. Herr Siemens does not state the quality of gas which he employed in his lamp; but, whether it were cannel or common, I wholly decline (in the present state of the question) to believe that a sixfold increase of illuminating power, or anything like it, was obtained or is obtainable by heating the gas and the air in the process of gas-combustion.

Is it the Hot Air or the Hot Gas?

Mr. Bowditch, followed by Drs. Frankland and Letheby, heated the air supply to the flame, but not the gas itself. Herr Siemens heats both; and he claims a tenfold increase compared with that obtained (somewhat doubtfully) by Dr. Letheby. Now, in Herr Siemens's experiments, what is due to the hot air, and what to the hot gas? This is a point which he could readily determine; and its determination would serve most usefully as a guide both to others and to himself in the further development of his system which he contemplates. That heating the air supply promotes intensity of combustion, I have no doubt; but I have great doubts as to whether, as a practical matter, heating the gas makes any appreciable difference. I doubt very much whether Herr Siemens's lamp heats the gas up to 300° Fahr., and, until the opposite is proved, I must believe that such a temperature in the gas before ignition will make no difference, considering that on ignition the gas at once attains a temperature of upwards of 3000° Fahr., if not still higher.

There is one characteristic of the Siemens lamp which must be favourable to intensity of combustion—namely, the fact that the burner itself is highly heated, and from another source than the gas-flame; a point which I have treated at length in my Second Part. Nevertheless, throwing this into the bargain, I shall await correct experiments with the Siemens lamp with great interest, but with no small incredulity as to the results at present claimed for it.

The Wigham Triform Burner.

It is only fair to state that the first application, in a practical form, of heating the air and gas was made by Mr. Wigham, of Dublin, in his large triform and quadriform burners for lighthouses. Mr. Wigham deserves the credit of having been the first to successfully construct a really large gas-burner; and further, as regards a combination of jets or flat-flame burners, the Wigham Burner of 1870 utterly eclipses the small combinations of such burners which have recently been acquiring notoriety. What are three or four flat-flame burners placed together in a lantern compared with 100 of such jets, with their flames combined, as in the Wigham burner of ten years ago?

When reporting upon Mr. Wigham's triform burner—which consists of three of his burners placed in a tier—Professor Tyndall and others state that there is a distinct superiority of illuminating power in the upper burners—those that are supplied with heated air, which passes through the undermost burner; but they do not venture to estimate the precise degree of this superiority. Had it been 500 per cent., or even 100 per cent., I am sure they would have said more about it.

Warrington and the Liverpool Corporation (Vyrnwy) Water Scheme.—A statutory meeting of owners and ratepayers of Warrington was held last Wednesday, at which a resolution was passed approving of the Town Council's proceedings on the 4th inst., when it was agreed to oppose the Bill of the Liverpool Corporation to carry out the Vyrnwy water scheme. The main object they have is to prevent the laying of water-mains in the bed of the Mersey, as they are of opinion that it may impede the navigation of the river, and they consider it desirable that the mains should be laid some distance below the bed. Another object they have in view is to obtain clauses in the Bill so that Warrington may, if they wish, be supplied with water from the same source.

Correspondence.

[We do not hold ourselves responsible for the opinions expressed by Correspondents.]

CORPORATION MANAGEMENT OF GAS UNDERTAKINGS.

SIR,—Approving as I do most thoroughly of the principle you have so constantly enunciated, that gas profits should be for gas consumers, it has often appeared strange to me that you have never enforced your arguments by reference to what is perhaps the most uncompromising example of that policy. I am prompted by your observations in the "Circular to Gas Companies" in your last publication, to ask you to allow me to supply the omission.

Five years ago, when I entered upon my duties in Leeds, I found that profits accruing from the business had been uniformly handed over to the borough fund, whilst at that particular time a very large deficit on the year 1874 was owing to the same. The profits of 1876, however, sufficed to clear off this indebtedness, and the account once squared, I was delighted to find that my Committee, almost to a man, were favourable to what I think I may fairly designate as the *free trade* principle.

The result has been eminently satisfactory, as the following statement of the prices charged for gas will show :—

Year ending June 30,	1876	3s. 9d.	per 1000 feet.
" "	1877	3 3	"
" "	1878	2 9	"
" "	1879	2 6	"
" "	1880	2 2	"

And I see no reason why further reductions should not, year by year, be made for some time to come.

At the commencement of each financial year my Committee instructed me to prepare an estimate of probable income and expenditure. In preparing that estimate, it is my duty to avoid a balance if possible (large balances being considered by my Committee as bad financing), and so I anticipate all such matters as increased business, altered values of material bought or sold, reduction of leakage, improved carbonization, &c., with the object of reducing the price to the lowest figure. And although, notwithstanding every effort to avoid them, large balances of profit have resulted, my zest in pursuance of the policy is such, that I am hopeful of limiting them in process of time to something inconsiderable. I contend that this principle is just and equitable as well as expedient.

Gas consumers, whose interests are in the hands of companies, have a vested interest in all the improvements which have been effected at their (the consumers) charge. Antiquated directors, managers, or apparatus—or, perhaps, all three combined—may have inflicted a very heavy tax upon them in the past, and it is, therefore, only fair that those who have borne the brunt of disastrous combinations, should be entitled to receive the prospective gains of better knowledge, skill, and appliances.

It is often contended that the ratepayers having incurred the liability in relation to capital, are entitled to appropriate the profits. The argument, in my opinion, is most illusory. Let me put a case in point. The capital of a corporation gas undertaking is £100,000; the profit, after paying interest, £10,000. The ratepayers of to-day pay, say, 1 per cent. on the capital to a sinking-fund—£1000—in aid of posterity, and appropriate the £9000. Meanwhile the business is increasing, and the capital is being augmented at a rate probably exceeding threefold the amount of the sinking-fund. As a consequence of this policy, the price is high, and gas is the more assailable by competition, while the liability of the ratepayer *of the future* is ever increasing. Now there is no reason whatever in the arguments of the ratepayers advocates, unless it is conceded that gas *may* be superseded. Yet there are many places where gas—which might be made almost as necessary, and, therefore, as invulnerable as coal—is being subjected to competition by being kept at a high price, and the interests of future ratepayers jeopardized by the very process designed to protect them.

Leeds, May 21, 1880. HENRY WOODALL.

ON THE EFFECTS OF HEAT IN RAREFYING GAS IN BURNERS.

SIR,—"Willing to Learn" overlooks what appears to me the chief fact and element in the question. The lighter the specific gravity of a gas, the more readily does it ascend, or pass through an orifice in any direction. In other words, a larger volume of a light gas will pass through an orifice, within a given time, than of a heavy one; the explanation being, that there is less matter within any given volume of the lighter gas.

Now, the gas within the burner being heated, expands, acquiring a lighter specific gravity; so that, the pressure behind remaining the same (*i.e.*, the pressure from the main), a larger volume of this lighter and thinner gas will issue from the burner than would occur if the gas remained cool, denser, and heavier.

That no more gas can issue from a burner than enters it needs hardly be said; but if the gas be expanded *within the burner*, while the supply or pressure from behind remains as before, the gas must issue in larger volume, and also, or therefore, with increased velocity. At least, so the case appears to me.

For illustration :—Take a tube through which water is flowing, and apply heat to the tube near the outlet, so as to vaporize, or convert into steam, the water or a part of it. Undoubtedly the steam (the expanded and vaporized water) will issue in larger volume, and therefore with greater velocity than water would do. Of course it issues also possessed of greater pressure. A cork which would stop the flow of water would be blown out when the water is expanded and converted into steam.

Further, as is well known, the poorer the quality of a gas—*i.e.*, the thinner and lighter it is—the more damaging is the effect of pressure or velocity of issue upon its illuminating power.

I may take the liberty to add that, were it usual to do so, "Willing to Learn" is precisely the motto which I should desire to prefix to the papers I am now writing. I am endeavouring to arrive at correct conclusions upon some matters of combined practical and theoretical interest to the gas profession. It may be easy to form an opinion upon a single set of facts, or on one separate view of the case; but it is no easy matter to see that all the facts are set forth and collectively taken into consideration. This will be found especially true as regards the article which will appear next week; and I shall be thankful for the opinions and knowledge of others upon the (to me puzzling) phenomena, with which I shall deal as I best can.

May 22, 1880. R. H. PATTERSON.

SIR,—We have noticed the inquiry of "Willing to Learn," in your issue of May 18, and we think he has not sufficiently studied the question in relation to different descriptions of gas-burners. His letter seems to imply that he is thinking only of burners having a larger orifice at the base (through which the gas is admitted) than at the outlet, or point of ignition; and if so, he would be probably correct in his conclusion. But it has been now for many years recognized that the law for burning gas economically is to have a larger *outlet* at the burning point than *inlet* at the base of the burner, so that the pressure is greatly reduced before it arrives at the point of ignition; and this law holds good both with Argand and flat-flame burners, which is evidenced by the fact that the area of the orifice at the burning point in Brönner's burner is many times larger than the area of the orifice at the inlet of the burner. So with the "London" Argand, the combined area of the orifices at the top or burning point is also many times larger than the combined area of the three small tubes supplying gas to the body of the burner. It therefore follows that the gas has plenty of room to expand in the chamber of the burner, and the pressure is consequently reduced to a very low one at the burning point; and "the pressure in the burner" is not (as "Willing to Learn" puts it) "greater than the pressure of the gas entering the burner," but, on the contrary, many times less.

There is another point in Mr. Patterson's article with which we entirely concur. It will be found in your last issue, p. 751, under the heading, "Effect of Non-Conducting Burners on Illuminating Power," where he says "the steatite abstracts less heat from the flame than the metal does." This is so to such an extent that it is possible with Brönner's burners to take hold of them firmly between the fingers while burning, quite close up to the steatite top. The temperature of the body of the burner, which is of brass, is scarcely warm; and, indeed, the lower part of the burner is actually cool. The steatite top, however, is intensely hot, which does not bear out Mr. Patterson, that it, the *steatite*, keeps itself cool; but, as it appears to us, being a bad conductor and a good absorbent of heat, it retains the heat within itself, and does not allow it to extend to the body of the burner.

155, *Cannon Street, E.C., May* 22, 1880. HENRY GREENE AND SON.

PUMPING GAS AT BECKTON.

SIR,—We learn from Mr. Trewby's letter, published in the JOURNAL of the 18th inst., p. 752, "that I do not pretend, nor am I fool enough to claim, the slightest novelty for the arrangement specified, as it is just what any engineer would stipulate for, considering the circumstances of the case." Now, Sir, if you will refer to your JOURNAL of the 20th of April, p. 590, you will find that the system was described as a "novelty," and "the whole arrangement was designed by Mr. G. C. Trewby." Our letters were written to correct this statement.

The patent of Mr. John Beale, to which Mr. Trewby refers, was for a *steam-engine*, and has nothing to do with the arrangement now referred to.

Mr. Trewby does not notice our statement that a *fac simile* of the plan described as a "novelty," and his "design," was engraved and explained in our "Gas Catalogue" of 1877, a copy of which was sent to him at the time (long prior to the specification of 1879, written by himself, to which he refers). He ignores also the fact that we had *erected prior to that date* our new patented steady machines at Liverpool, Bromley, &c.

We do claim to be the first to see the necessity for the use of absolutely steady gas exhausting and pumping machinery, capable of conveying gas from one station to another (or to distances), and *to have invented a perfect system of accomplishing these objects, which has never hitherto been done.*

Essex Street Works, Strand, W.C., May 24, 1880. GWYNNE AND CO.

MR. SUGG AND THE HOLLOW-TOP BURNER, ETC.

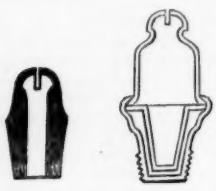
SIR,—Though Mr. Sugg's beginning of this controversy with a two-column letter gives me the right, by your favour, to have the last word, I should not have availed myself of the privilege had not he introduced into his last letter a sworn "declaration," which he gives as evidence in support of his oft-repeated statement that he was the inventor of the hollow-top burner, so called by him. As I have had something to say on this subject before, and have often been asked by gas engineers and others what are the recorded facts relating to the invention of this burner, and as it is a matter of historical interest, I will supply proof of who were the inventors.

In passing I may say, what I have often said before, that whoever is entitled to the honour of originating it, I claim none of it; I am simply an improver of it. I patented a new and improved mode of manufacturing it in my own plastic material, "enamel," in 1877. In January, 1879, I greatly enlarged its capacity and lighting power, as is well known; and for a purpose that has now become notorious, Mr. Sugg paid me the compliment—such as it is—of copying these enlarged and improved burners for use at Birmingham. As I have previously shown that Mr. Sugg did not patent these improvements, as he said he did, nor mention the burner in any patent in 1874, the above may be taken as my established position in reference to this burner; and whether Brown, Jones, or Robinson invented it, it makes no matter to me, except as one connected with gas matters, and interested in seeing honour given where it is due.

If there could be no invention shown prior to the earliest date Mr. Sugg has fixed upon when he made his historic model, the making of the model would not alone entitle him to the credit he claims. It is he who by his own efforts first made a success who is entitled to the credit, and not the man with the invention in a chrysalis state. Mr. Sugg does not claim to have done more than make a model, and that it now ap-

pears was not in "1873," "about 1873," nor "1872," but, according to the sworn testimony, the date was 1868. I will now show that the burner was patented in 1860, and that will dispose of Mr. Sugg's statement that Mr. John Goodson made, by his instruction, the "model for the first hollow-top burner."

This will be seen from the engravings which I send herewith. The small one is a copy of fig. 1, and the larger one a copy of fig. 2, of the filed drawings of patent No. 2574 of 1860.



Those who know my slit-unions, and the excellent burners of the same kind made in steatite by the Germans, from whom Mr. Sugg procures his, and terms them the hollow-top, will at once see that these are the same as those shown in the engraving. The small engraving shows a burner made out of solid material, and the head is chambered or hollowed out by a specially-made tool. The larger engraving shows the same burner (with additions) made out of sheet metal. Referring to burners made out of solid material, the specification says: "Our improvements consist in causing the internal cavity or canal of the stem, pipe, or tube of the burner to terminate towards the apex of the burner in a small bulb or enlargement of the cavity." The improvements in "sheet metal burners consist in narrowing the pipe, stem, or tube of the burner a little below the apex, so as to form a neck or contracted passage, above which, and between the orifices or orifice through which the gas passes for combustion, the upper part of the burner is formed into a small bulb or *hollow chamber or cavity*." The patentees were the Brothers Wadsworth, and the manufacturers, who have been supplying the burners ever since, are Messrs. Ralph Heaton and Sons, the Mint, Birmingham. In 1868, the last change of time at which Mr. Sugg says his man made "the model for the first hollow-top burner," *millions* of the burners were in existence, and were to be found in not less than half the gas-fitters shops in the kingdom. This patent puts a difficulty in the way of Mr. Sugg's claim, which I leave him to remove.

And now, Sir, pardon me for trespassing for a line or two more on the lamp question, and then my disagreeable task is finished. Mr. Sugg says in his last letter, alluding to myself, "If you read his letters you will see that he does not dispute my position—that in all points in which our lanterns are similar, either I or some other person has anticipated him." This is a characteristically vague statement, and without pretending to know what it means, I will say that whenever he has ventured to make a specific statement I have not only disputed his "position," but have in every case made him change it; and, if I had changed mine as often as he has changed his, I should have considered that I had no position left worth keeping, and that the less said about those I had occupied the better. I will now state that my two patents are the result of six months of wearying experiment—first in the laboratory and then outside; 50 feet from the ground I experimented to secure efficiency in atmospheric commotions; and step by step the apparatus was built up, each part being experimented with until it was made to answer the purpose required. There is not a feature that is essential to the apparatus, or that is patented, for which I am indebted to any person, or that is not new for the purpose to which it has been applied. That my apparatus was properly conceived and carried out is proved by the fact that, though last in the field, it has distanced all competitors in fair fight.

I thank you for the patience and courtesy you have shown to me during this controversy.

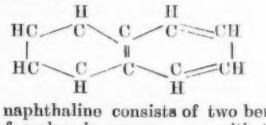
G. Bray.

Blackman Lane, Leeds, May 22, 1880.

THE FORMATION OF NAPHTHALINE.

Sir,—As the proceedings of the Southern District Association of Gas Engineers and Managers, at their meeting on the 13th inst., have been reported in the Journal, I should like to correct a remark I made in the discussion, the erroneousness of which will be apparent to any chemist reading the report—viz., the statement in reference to the hydrocarbons contained in gas, that "they are all homologues of the radical CH_2." This is, of course, only true of the *gaseous* hydrocarbons of the olefiant series, and not of the hydrocarbon *vapours* in suspension, these belonging to the benzol class, C_6H_6.

Dr. Max Zäugerle, in his "Lehrbuch der Chemie," regards naphthaline ($C_{10}H_8$) as a derivative of benzol, in which two atoms of hydrogen are displaced by the bi-valent group C_4H_4 (diacetylen), in accordance with the following diagram:—



According to this, naphthaline consists of two benzol groups having two of their atoms of carbon in common one with the other, and may be expressed by the formula $C_2 \begin{cases} C_4H_4 \\ C_4H_4 \end{cases}$

It would be interesting to know the opinion of some of our own chemists in regard to this point, for if this view be correct, it would appear probable that naphthaline is formed during the process of cooling by the breaking up of some of the hydrocarbons—possibly acetylen (C_2H_2)—and the association of their atoms of carbon with benzol groups as shown above.

G. E. Stevenson.

Gas-Works, Peterborough, May 21, 1880.

Bolton Corporation Gas Supply.—In the course of a discussion, at the last meeting of the Bolton Town Council, as to the price paid for certain land purchased for an extension of the gas-works, the Chairman of the Gas Committee (Alderman Moscrop) stated that five years ago the maximum quantity of gas made in the day of 24 hours was 2,655,000 cubic feet. Since that period not an additional yard of land had been taken to extend the works, yet on the 17th of January this year the maximum consumption of gas was not less than 3,267,000 cubic feet, or an increase on that of five years ago of 23 per cent.

Miscellaneous News.

PRESENTATION TO MR. CORBET WOODALL.

On Thursday evening last a gathering of a very interesting character took place at the Vauxhall works of the late Phœnix Company. In response to the invitation of Mr. Corbet Woodall, all the men employed at the Bankside and Vauxhall stations who could be spared from their duties, some 500 in number, together with the officers of the engineering and distributing staffs, assembled in a marquee which had been erected on the works for the purpose, and partook of an excellently served "knife and fork" tea. A concert was afterwards given in a large room adjoining, which had been tastefully decorated for the occasion. In the course of the evening, Mr. Woodall took occasion to say that he did not like to leave the men, with whom he had worked pleasantly for a good many years, without an opportunity of saying good-bye to them collectively. He paid a cordial tribute to the general good conduct and loyalty of the men, and also to the considerate treatment which had always been accorded to them by the late Phœnix Board. He expressed confidence in the happy future of the Company and its *employés*, and urged the latter to increased personal interest in the success of the undertaking.

Mr. J. F. Braidwood, the Superintendent of the Vauxhall station, then expressed the regret which was generally felt at Mr. Woodall's withdrawal from the Company, and the respect and esteem in which he was held. In the name of those assembled, he presented him with a set of beautiful silver epergnes, and a bracelet for Mrs. Woodall, and, amid hearty cheers, wished him and his family much happiness and prosperity in the future.

Among other changes consequent upon the amalgamation, Mr. Braidwood, who has been Mr. Woodall's assistant for eight years, and during the greater part of that time resident at Vauxhall, is appointed Engineer to the Greenwich station of the Company. To him also, on his removal from them, the men and officers of the works presented a token of their goodwill in the form of a silver tea-service.

The proceedings were marked throughout by great heartiness and cordiality, and indicated a spirit between masters and men which we should be glad to see generally prevalent.

THE USE OF GASEOUS FUEL.

At the Meeting of the Society of Arts on Wednesday, the 26th ult.—Lord A. S. Churchill in the chair—a paper was read by Mr. T. Fletcher, of Warrington, "On the Use of Gaseous Fuel, with Special Reference to its Application to Laboratory Furnaces." It was as follows:—

The first point to be considered is the special nature of the fuel. It must be understood that my remarks apply, in many points, equally to the ordinary gas, as made from coal, for lighting purposes, and also to air charged with the vapour of the lighter petroleums and other hydrocarbons. When gas is made from coal, a part only of the coal is volatilized and converted into gas. To get an idea of the actual fuel value of ordinary gas, I will take the results as obtained at the Manchester Gas-Works, where a mixture of 75 per cent. of cannel and 25 per cent. of coal is used. From one ton of this mixture the residue is about 13 cwt. of coke, 13 gallons of tar, and 25 gallons of ammonia liquor. The gas produced measures 10,000 cubic feet, which, if reduced to the solid form again, would weigh about 350 lbs. If we calculate this at, say, 1s. 2d. per cwt., which is a liberal allowance for its fuel value, we get the working value of gas as a fuel at about 4d. per 1000 cubic feet. The actual cost of the gas as delivered into the mains, including the labour, fuel, and materials used, is about 1s. 1d. or 1s. 2d. per 1000 feet. When these figures are compared with the cost of gas to the consumer, the difference is startling, and the fact is brought pretty forcibly to our minds that we have an excessively costly fuel to deal with.

In actual use, and when burnt with proper attention to details, it is not even so costly a fuel as coal for work which requires heat on a comparatively small scale and at intervals; in fact, for most of the work to be done in small laboratories, and also for cooking purposes, it has proved itself to be a cheaper fuel than coal or coke, owing not only to the fact that every cubic foot of gas burnt may be made to render its full duty, but also when the necessary work is done the expense is instantly stopped.

Gasoline, benzoline, and petroleum, which are hydrocarbons, are all practically the same as coal gas in composition, varying only from each other in the temperature at which they begin to give off inflammable vapour. If we take them weight for weight with gas, a simple calculation shows them to be worth, as fuel, about 10½d. per gallon, coal gas being 3s. 6d. per 1000 cubic feet, one gallon being about equal in fuel value to 250 feet of gas.

It must be clearly understood, in referring to the comparative cost of the liquid hydrocarbons, that the value, as compared with coal gas, is only true when they are burnt as gas or vapour. When used as spray with steam, or a cold-air blast, the cost is very greatly increased, owing to the large quantity which is mechanically carried into what is practically a bath of carbonic acid gas, in or at the back of the fire, and which partially or entirely prevents its combustion. The duty obtained in spray furnaces is exceedingly low, and they are—so far as my experience enables me to judge—most costly and wasteful of fuel, unless a hot-blast is used, so as to entirely vaporize the liquid before it begins to burn.

The figures I give are necessarily vague. Gas varies in quality, not only in every town, but also to a limited extent in the same town from day to day, and any exact figures for one place would not be correct for another. I simply give a rough idea of the fuel we have to do with, as regards its practical value. When we consider the cost of gaseous fuel, it becomes of serious importance that the method of burning, so as to obtain a high duty, requires careful study.

So much has already been done, that gas, even at its present high price, may be fairly considered a cheap fuel, both for workshops and domestic use.

Before saying anything as to the flame to be used in furnace burners, I will explain the material used to retain the heat, and without which I believe it would be impossible to obtain many of the results which I will at the conclusion show you. It certainly would be impossible to obtain them without a very greatly increased consumption of gas. The material of which all the furnace casings I have here to-night are made, is produced by a process patented by myself some years ago. It is a mixture of one part of refractory fire-clay or ganister, and from three to six parts of sawdust, the proportions being taken dry, by bulk. These are mixed, preferably with rice-flour paste, but water may be used for the heavier varieties, until slightly cohesive, rammed into moulds, and fired in an open kiln, with free access of air, so as to burn the sawdust out. The result is a cellular clay, similar in texture to bread, and which retains the heat so perfectly that I can, in this casing, which is only one inch thick, melt a crucible full of cast iron, and then take the whole in my bare hands and carry it about.

It will probably be better at once to explain the mode of making air gas from benzoline or petroleum spirit, as my future remarks, except, perhaps, for blowpipe use, will include both air gas made from spirit

petroleum, and also coal gas. I find, with my more recent pattern of burners for both draught and blast furnaces, that coal gas and air gas may be used interchangeably, and for many of the more delicate purposes I prefer the air gas, as being free from sulphur. The generator which I now show you contains a layer of spirit petroleum at the bottom. In this the ends of cotton screens stretched on wire are immersed, the spirit is absorbed and carried by capillary attraction up the cotton, exposing a large surface of spirit to the air which is blown through. To perfectly saturate the air with the vapour, the box is divided lengthways in such a manner that the air passes backwards and forwards four times the length of the box, and in traversing this distance has to pass through 32 cotton screens, each about 5 inches square. A similar arrangement is used by the Sun and Alpha air gas apparatuses, these having also a mechanical blowing arrangement. They are, however, excessively costly for furnace work, having complicated and bulky parts, totally unnecessary except for lighting purposes.

Before going further, I must set right one great misconception with regard to the heat obtained from a gas-flame. Many people imagine that a Bunsen, or blue smokeless flame, gives a larger quantity of heat than an illuminating flame. This is not the case. If the gas is equally well burnt, the total amount of heat from each is precisely the same, but the heat differs in one most important point in character.

The radiated heat—*i.e.*, that which travels in straight lines in all directions from the flame, and which makes the pleasant feeling of a bright fire—is far greater in quantity from an illuminating flame than from a blue one. If we want to cook a joint of meat by gas, and get the same satisfactory result as when roasted before an open fire, we use the direct radiated heat from illuminating flames placed over the meat and inside the oven. If, without altering anything else, we convert the illuminating flame into a blue one, by mixing air with the gas before burning, our cooking is practically at an end; the radiated heat disappears almost entirely, and, to get any result, we must now put the meat over the flame, and bake instead of roast it. As you see, the hand may be held almost in contact with a non-illuminating flame, obtained by burning a mixture of gas and air. When I stop the air supply, the radiated heat becomes so intense as to be unbearable.

The actual temperature of an illuminating flame is very high, much higher than that of a blue flame; in fact, in a good illuminating flame, at the point where the white part commences, near the centre, it is sometimes possible to fuse an exceedingly fine platinum wire. It is this very high temperature which, to a great extent, causes the radiated heat observed; and, for the same reason, it is useless to expect a satisfactory gas fire made by heating blocks of asbestos with a gas-flame, until a very much higher temperature flame is used than is the case at present. When we have a crucible or solid body to heat, radiated heat is not wanted, and the most economical plan, so far as is known at present, is to use a blue smokeless flame, and to place the body to be heated in actual contact with it. By this means the heat is rapidly taken from the flame without the deposition of soot, and without loss of heat by radiation into the surrounding air.

We must now consider the fact that all flames under ordinary conditions are hollow and cold inside. I have here a pile of gunpowder, which I will place in the centre of a large and powerful flame. You see that not only will the gunpowder remain unchanged, but the centre of the flame is actually cold. To show this more clearly, I will use a burner with a flame which can be made either solid or hollow. I will first place the gunpowder in the hollow flame, and then convert it into a solid one, and thereby ignite the gunpowder. With care, it is possible to put the hand in the centre of this flame, provided the wrist is protected by wet cloths from the outer film of flame; but it is difficult to prevent scalding by the steam which is formed by the outer film of flame and the wet cloth. The actual temperature in the centre of the flame I have tested by introducing a delicate thermometer, and find it is usually about 110° Fahr. I will also prove that it is hollow, by conducting the unconsumed gas and air from the centre of the flame by a tube, and igniting it, making, as you see, a second and separate flame, this second flame disappearing when the flame is made solid.

I believe that the honour of being the first to obtain a solid flame is due to Mr. Wallace, of Manchester, whose plan I shall explain presently. He was, in fact, the pioneer of a new revelation with regard to gaseous fuel, and I am sorry to say his discovery has not yet obtained the attention it merits from all makers of gas apparatus for heating purposes.

There is one condition, with regard to gaseous fuel, which requires close attention. The vessels to be heated are, as a rule, short and small; the gas must, therefore, be perfectly burnt not later than the instant the flame touches its work, and thus, for most purposes, a hollow and long flame is comparatively worthless. To render the combustion more rapid, and to thereby shorten the flame, Mr. Gore, of Birmingham, first hit on the expedient of subdividing it into layers, producing a number of narrow flames with air spaces between. By this means he produced a short compound flame, which, with a little assistance from a chimney draught, would fuse cast iron in a crucible. Following in his steps, Mr. Griffin, of London, produced a multitubular burner, virtually the same in effect as Gore's—in fact, a form of burner almost identical with Griffin's is shown in the specification of Gore's patent.

These earlier burners had all one serious fault. If the chimney draught happened to be too great for the quantity of gas available, or if the gas supply was irregular, an excess of air was pulled in and mixed with the gas, rendering the mixture explosive, and causing the burner to what is commonly called "light back." To prevent this, Mr. Stanistreet, of Liverpool, placed, as an experiment, a sheet of wire gauze on the top of the tubes, and communicated the result to me. With this arrangement the gauze was destroyed every time the furnace was used, and to obviate this I placed the gauze under the tubes, thus making the first high temperature draught furnace burner which would bear sudden changes of the gas supply without an explosion. This burner has now been superseded by another form, which I have recently invented, and which, in principle and arrangement, is totally different. To explain the principle of the new burner, I must go back a little.

Mr. Wallace's burner is an upright tube, open at the bottom, with a small gas-jet underneath, pointing directly upwards. The top of the tube is covered with a perforated copper cap. The rush of the gas from the jet carries upwards with it a large quantity of air which, with a gas-jet of one exact size, produces an explosive mixture. The perforated cap prevents the flame rushing down the tube, and we have what we never had before—a solid flame, requiring no external air supply, produced by the quiet burning of an explosive mixture of gas and air. This being the case, we obtain a short flame of very high temperature, which requires no excess of air to ensure perfect combustion, and we therefore work so as to get the highest possible duty from our fuel.

Following in the steps of Wallace, I found great inconvenience from the height and size necessary to produce large and powerful flames; but after a long series of experiments I hit on the plan of placing Wallace's injecting-jet at one end of an open horizontal tube, leaving the other end open, and enclosed in a tight box, the upper side of which is covered with gauze. With this burner I obtain a flame solid to the centre, in a convenient and simple form. I find from experience that there is no practical limit to the size of burners made on this principle. I have made them 18 inches in diameter on the surface of the gauze, capable of burning in one solid flame a gas supply of 200 cubic feet per hour; I have also made them 4 feet in length for coffee roasters. As this burner requires only an outlet for burnt air, it will work perfectly in very confined spaces, where an ordinary hollow-flame burner cannot be kept lighted. A very beautiful application of this burner has been patented by Messrs. Bonser and Son, of Tower Hill, for the purpose of roasting coffee, the burner being placed inside the roasting cylinder.

I have here one of Bonser and Son's sample roasters, which will roast 1 lb. of coffee in about five minutes, and which is well worthy of examination, and also a solid-flame burner, 8 inches in diameter, which, with a well-constructed boiler, will generate steam sufficient for a 1-horse power engine. When I use this burner for draught furnaces, I make it with a cast-iron grid, to prevent any liability of the gauze to get red hot, and to prevent also the peculiar roaring noise caused by a solid flame produced with the assistance of a chimney, and which I shall again refer to; and you here see a few examples of its application for crucible, muffle, and porcelain painters furnaces. One great difficulty with gas crucible furnaces has been a means of safely supporting a crucible, so as to hold it securely without interfering with the full impact of the flame.

Gore, in the first gas furnace made, supported his crucible by projecting ribs inside a taper cylinder. This caused liability to stick fast, and also necessitated the use of crucibles of one exact shape and size. Griffin made an advance on this, by carrying the crucible on a tripod grate of fire-clay. This, although used at present, is liable to damage, and is not altogether satisfactory. Another plan introduced is to fix an upright plug of fire-clay in the centre of the burner, which is, in my experience, worse than Gore's original plan, as the stand is unsteady, and is also liable to stick to, and come away with the crucible.

For draught furnaces I have at last solved this difficulty completely, by placing the crucible on the solid bottom of the furnace, by the side of the burner, and drawing the flame sideways across the crucible, the chimney being placed at the opposite side of the burner. This not only completely solves the difficulty, but places the chimney in the best possible position, and exposes the crucible more perfectly to the impact of the flame. I have received to-day a model of a further improvement on this, in which the flame is made to traverse completely round the crucible, thus still further utilizing the heat of the flame.

In blast furnaces, the difficulty of the supports is also overcome by placing the crucible on the bottom of the furnace, and inserting the burner at the side. The casings by which the heat is retained are of porous or cellular clay, the process of making which I have already described. All the casings which you see here to-night are made of this material, which I consider one of the most important points, where economy of fuel, speed of working, and great heat are required. Without this cellular clay, the results I obtain could not be approached, except by an enormous increase in the heating power of the burners used.

I do not think it probable, or possible, that really high temperatures will ever be attained in small draught gas furnaces, for several reasons. First, the very large burner surface necessary to make a perfect mixture of gas and air, with sufficient rapidity to burn a large quantity of gas instantly and perfectly, makes the burner liable to damage. It will be found that, with a draught gas furnace, burning in an economical manner, the flame is in absolute contact with the burner surface—a state of things which, curiously enough, does not exist with a blast furnace, where the flame is always at a greater or less distance from the face of the burner. For this reason I should never recommend the use of draught furnaces with long chimneys for high temperatures, although for such work as the fusion of brass, silver, and gold, the usual routine work of laboratories, and the firing of glass, china, &c., they are perfectly adapted, and, if well constructed, will give a very high duty for the gas consumed. Another objection to draught furnaces is the difficulty of having all the lids and parts fitting so perfectly air-tight as to keep all cold air out of the chimnies, and thereby interfering with their satisfactory working. Where the pull of the chimney is great from its height, there is a great liability to this leakage of cold air into it, and there is also a great waste of heat in keeping the chimney at a sufficiently high temperature to enable it to work efficiently. Draught furnaces have their place and fill it, but for many purposes there is nothing to approach a blast furnace, used with either coal gas or gasoline vapour.

The furnace I now show you is perhaps the most perfect example of the great results to be obtained with gaseous fuel. The casing which holds the crucible is a simple thick pot of my porous clay, with a hole in the side, and a lid with a hole in the centre for the escape of the products of combustion. The burner, I consider, is as perfect for its work as the casing. It is a true solid flame, formed by injecting, with a little foot blower, a fine stream of air at a high pressure into a tube, into which gas or gasoline vapour enters at the side. By using the air at a high pressure, the larger quantity of air required for combustion is pulled in mechanically at the openings in the tube, thus dispensing with the large and costly blowing apparatus which would otherwise be necessary. The end of the tube against the hole in the casing may be open, but is then liable to make a rattling unpleasant noise. To prevent this, I cover it with a cap of gauze, which, when the furnace is at a blinding white heat, is perfectly cold, partly owing to the fact, as I previously explained, that a gas-flame produced by a blast is never in absolute contact with the burner which produces it, and partly to the constant blast of cold air and gas passing through. The burner fits tight against the casing. A perfectly explosive mixture is made rapidly in very small quantities, and burnt in a close non-conducting chamber so perfectly and so instantaneously, that not a trace of flame is visible in the furnace. In this furnace I can, as you will see, starting all cold, get a crucible well over a cast-iron melting heat in five minutes, and to a blinding white, approaching a blue heat in ten minutes.

The gas consumed in this furnace, as I shall work it at the conclusion of the paper, is about 40 cubic feet per hour. It therefore requires less than 4 cubic feet of gas to raise a crucible, sufficiently large to hold 2 lbs. of cast iron, to over the fusing point of cast iron, and it takes about 7 cubic feet of gas to melt this weight of iron so that it can be poured. Let it be remembered that this quantity of gas costs a little over one farthing, and is equivalent to about 4 oz. of coal. Let it also be remembered that this minute quantity of fuel not only melts the iron, but heats up a cold furnace and crucible. It is very easy to work the furnace with only a small gas supply, but in this case the heat is obtained much more slowly, and the total quantity of gas used to obtain the same result is greater.

Greater power and greater rapidity of working than is shown by this furnace is not desirable, though it could be easily obtained by increasing the air and gas supply. No crucibles known will with ease stand a greater power than this furnace gives; whilst for simplicity of construction and ability to bear hard work, anything better could hardly be desired. With this furnace I think the art of heating crucibles by gas may be looked upon to be complete.

Consider, for one moment, the actual results obtained in this furnace with 4 oz. of fuel, and compare the number of pounds of coal or coke

necessary to produce the same result, then the economy of gas fuel, under proper conditions, becomes self-evident. Bear in mind also that it is applicable to either coal gas or air gas from benzoline, the latter fuel enabling the furnace to be used for the fusion of pure nickel and delicate coloured enamels and glass, which the sulphur always present in coal gas would otherwise prevent the furnace being applied to. When we consider the important part which nickel is likely to play in the future for many purposes, more especially in its pure and malleable form, this power of melting so refractory a metal in a simple furnace is a matter of no little importance.

I have only time to say a few words about blowpipes. The flame of a blowpipe is, to a certain extent, hollow; but not so much so as is the case with the ordinary flame, made without an air blast. The reason of the very high temperature obtained with a blowpipe flame is that the heat is driven to one point and accumulated there. I have here an example of an arrangement, devised by myself some years ago, for heating both the blast of air and the gas, producing a flame having a temperature far above that required to melt platinum. A blowpipe flame, however large, has little power compared with the burner of the blast furnace which I have just described, when we have large bodies of material to heat. The combustion is neither so rapid nor so perfect; in fact, the blowpipe flame is hollow and long, with only one hot point. The furnace burner flame is solid, short, and of equal temperature throughout.

I will now explain some of the differences between coal gas and gasoline or benzoline vapour, in practical use. Coal gas is never free from sulphur, and it is therefore difficult to use for the heating of metals and other substances which are liable to damage by sulphur compounds. It is also not satisfactory for the fusion of enamels, except in perfectly tight chambers, from which the products of combustion can be completely excluded. The vapours of the lighter petroleums, on the contrary, are free from sulphur, and I have repeatedly fused the most delicate enamel colours in the open flame without the slightest injury. Another curious difference in the two fuels is, that when gasoline or benzoline vapour is used with a blowpipe, the flame is exceedingly liable to blow out. I can use no other satisfactory simile, except that the gasoline flame appears to be "brittle," and not to hang tenaciously to the blowpipe as a gas-flame does. When anything is in the gasoline flame which is at a sufficiently high temperature to keep up the combustion, this is no disadvantage. In the furnace, air gas from benzoline burns with perfect steadiness, precisely like coal gas; but when we attempt to use it for blowpipe work, the flame is continually leaving the point of the jet and blowing out. In this respect the field for experiment is yet open.

I believe I obtained from my friend Mr. Bower, only last night, an idea which may serve to solve this difficulty, but which I have not been able yet to test. I found that with benzoline gas his blowpipe was much more satisfactory than my own, the only difference between the two blowpipes being that his had an exceedingly thick air jet; mine had a very thin one. The jet of thick glass or metal does not appear to lift the flame away to the same extent, and some experiments will be made in this direction.

It must be remembered that coal gas is lighter than air. Gasoline gas is, however, much heavier; and therefore atmospheric, or Bunsen burners made for coal gas, which are open at the bottom, will not work satisfactorily with gasoline gas, as the latter falls, and escapes from the lower openings. For gasoline gas, the only heating burners which can be used are those arranged in a similar manner to the solid flame burners, with a horizontal jet and air tube. On account of the weight of gasoline gas, if the generator is placed at the top of a building, the weight of the gas is sufficient to supply an Argand burner in the lower part of the building, although the pressure obtained is not sufficient to work any of the common lighting burners which do not require a chimney.

I have two exceedingly curious flames to show you. One is a solid flame, produced on a surface of gauze by a chimney draught, the chimney being free to vibrate. The explosions, by the management of the chimney, can be varied in their rapidity, producing different tones. I do not recommend this in its present form as a musical instrument; I simply show it as a curiosity. The other is a flame which requires close examination to see its beauty. It is produced under peculiar conditions. When the vapour of gasoline is burnt on a gauze surface, with just sufficient air to make a blue flame, the surface of the gauze is covered with innumerable round blue beads of flame, rushing about in all directions. I cannot offer an explanation of this, and I cannot produce the same effect with a coal gas flame under any conditions.

In conclusion, there are many purposes to which gas fuel can be applied far more perfectly than it is at present. In fact, we may say that its use, except in blast furnaces and blowpipes, is yet in its infancy; and the work done by Gore, Wallace, and others, may be considered only as a small sign of what is yet to come. I believe the time is, perhaps, not far distant when gas will be used exclusively for cooking purposes, and that its rapid adoption all over the world depends only on the makers of the apparatus. If the makers of gas-heating arrangements had to pay for all the gas wasted in their apparatus, I think many improvements would very quickly be made. My own experience is that the whole of the cooking for a family of eleven can be done perfectly, entirely without the assistance of a fire, at a cost of about 2d. per day for gas. When we compare this with the cost entailed by some apparatus now sold, the necessity for improvement is self-evident. Where liquids have to be boiled or vessels heated, the work must be done by one solid flame, not by a number or one hollow flame. The ovens and pans must be as shallow and broad as possible, and must also be no thicker than is absolutely necessary. I have seen gas-cooking apparatus in which some 2 cwt. or 3 cwt. of iron has to be heated before any satisfactory work can be done. My own ovens and pans are as thin as they can possibly be made, and I find, by experience, that our largest oven is fully hot in two minutes. In a properly-arranged water-heater, it requires about 1½ cubic feet of gas to boil one gallon of water. This is the result I get in actual work, under the best conditions. I may safely take it as an average, with the burners generally used for cooking, that from 5 to 12 cubic feet of gas are burnt to do the same work, owing partly to the improper construction of the burners, and partly to the faults, shape, and unnecessary weight of the vessels used.

Amongst the still more recent improvements in gas-heating apparatus which have not yet been made public, I may mention two. The first is a simple and cheap arrangement for melting and pouring into ingots of different shapes a few ounces of gold or silver, without the use of a furnace. My first arrangement of this kind was essentially different. In this, as you see, both blowpipe, crucible, and ingot mould are mounted on one rocking stand. The two sides of the ingot mould slide over each other, to enable ingots of different shapes and weights to be cast; and the rocking stand, clamp, and blowpipe are all obtained in a single casting, reducing the cost of the whole to a few shillings. It is well known that the toughness and working properties of gold are greatly improved by this method of melting with a flat crucible and a blowpipe, and the results compare very favourably with those obtained in the best furnaces. As regards time, a 3 oz. ingot can, with ease, be melted and poured in not more than two minutes.

Another and more generally important apparatus is what may fairly be considered a new discovery, so far as gas is concerned. It is only too well known that good steel is ruined if heated with a gas blowpipe flame, and that steel band-saws brazed with a gas blowpipe are brittle and worthless. It is also impossible to weld with the heat obtained from a blowpipe. I find, by using a small hearth which I have here, filled with coke, broken small, and by directing a blowpipe through the open tuyere, I can get a welding heat in about two or three minutes, and I obtain heat which is for all practical purposes as good as a charcoal forge. For the repair of small tools, and for such delicate forgings as are necessary for sewing-machines, &c., this new adaptation of gas appears likely to become exceedingly valuable. It is, in fact, a small self-lighting forge, perfectly clean and simple in use, and adapted for the most delicate work. Its value those only who have delicate steel forgings to make can appreciate.

A short discussion followed, and a vote of thanks was then passed to Mr. Fletcher for his paper.

MR. SUGG ON THE SCIENTIFIC USE OF GAS.

As already briefly noticed in our columns, Mr. Sugg, on Tuesday, the 20th ult., delivered a lecture, on "The Scientific Use of Coal Gas," before the Hull Literary and Philosophical Society. The lecture, which was abundantly illustrated by diagrams and experiments, was very well received; but with the greater portion of it our readers would be little interested, as it was a recital of facts with which they are, of course, thoroughly acquainted. There were, however, parts which deserve notice in our columns, and we take the opportunity of reproducing them.

After giving, in a popular kind of way, a description of how gas is produced and what are its constituent parts, the lecturer dwelt on the necessity of properly proportioned internal fittings for houses, as affecting the question of pressure. At this point he exhibited Joslin's patent apparatus for rapidly measuring the flow of gas by simple inspection. This apparatus, a description of which is appended, was fixed to one of the burners shown, and about it Mr. Sugg said: I have placed the burner on a very ingenious little apparatus, the invention of Mr. George Joslin, of Colchester. It is simply a taper glass tube which serves as a conduit for the gas that supplies the burner. It may be placed anywhere in the pipe conveying the gas. I have it here just under the burner. Within the taper tube is a small disc of mica, of such a diameter that when it falls to the bottom of the tube it fits closely to the sides. When I turn on the gas the mica disc rises in the tube till it has reached a point at which the quantity of gas required by the burner can escape from under it by the space between its edge and the sides of the tube. As the tube is taper, it is clear that the higher it goes the greater the space will be between the circumference of the disc and the sides of the tube, and *vice versâ*. Therefore, in order to know at a glance how much gas is passing, I have only to read the figures or degrees marked up the outside of the tube. These have been verified by trials with an experimental meter.

The lecturer then passed on to the question of the use of burners with and without governors to them; also as to the effect of artificial light on the eyesight. On this latter point he dwelt somewhat at length, his remarks being as follows:—

I have now to bring before you a subject of the greatest possible interest in relation to the use of artificial light. It is an indisputable fact that there is in the present day a large increase in the number of young men and women, and even children, who are obliged to use spectacles. In France and Germany, as well as in England, this subject has attracted the attention of scientific men, and it is one which must not be allowed to be passed over without serious consideration. The present high standard of education compels young boys and girls, and also young men and women, to work a great deal by artificial light. Some do their work by the aid of candles, others by lamps; but a great number employ gas. The light is, however, mostly insufficient and very flickering indeed. Now one of the most important things in relation to artificial lighting is the quality of the light, regarded from a chemical point of view. Solar light, as you are aware, is composed of heat rays, light rays, and chemical rays, and when a ray of light is made to divide itself, or split up, by being passed through a prism, we see that it is composed of the colours—red, orange, yellow, green, blue, and violet. This is called its spectrum. The red is the heat ray, and this tones off into the yellow or light ray; this changes into the green, then becomes blue, and finally ends in violet. The greatest heat is found to be beyond the red ray of the visible spectrum, while the greatest chemical effect of light is, in like manner, beyond the visible spectrum on the other side. The chemical or "actinic" ray, as it is called, is that which produces the greatest effect upon a photographer's sensitive plate, and without this ray we could not obtain a satisfactory photographic portrait.* But there is a remarkable variation in the state of daylight with regard to its chemical property during the hours of the day. At early dawn there is light almost without actinism, or chemical rays; but as noon approaches the light of day increases in actinic power, and in the afternoon rapidly declines, till at evening we have a light almost devoid of actinic property. In like manner as the actinic ray, or chemical ray as it is usually called, to distinguish it from the other component parts of light, acts upon the prepared photographic plate, so it acts upon that most perfect of all photographic apparatus, the human eye.

Light which contains a great quantity of actinism injures the optic nerve, and renders it insensitive, exactly as a photographic plate is rendered useless and insensitive by the same agency if it is over-exposed to it. Therefore, the most natural thing that occurs to all human beings is to get out of the blinding glare of daylight at noon into rooms or shaded places where there is light with but little actinism. The rapid diminution of this chemical property of light towards the close of day points out to us clearly that the eye must not be exposed for too great a length of time to the action of the actinic rays. Consequently, it seems to me that what we want as an artificial light is that kind of light, so agreeable to the eyes, which we have on summer evenings—white and diffusive, but almost devoid of actinic rays.

Now, if we read by the light of a candle placed too far from us, the pupil of the eye is abnormally dilated, and the diaphragm of the eye is opened to its widest extent to take in all the rays of light possible. This arrangement, which is quite suitable to the construction of a cat's eye, is altogether unsuitable to the human eye. The delicate nerves are over-strained, and, in time, become permanently injured. If we use the candle near to the eye, the greatest amount of the sharp speck of light falls on the eye, and prevents us from seeing so distinctly the object we are looking at. The greater and more brilliant this light may be, the more the evil is intensified. The extreme is reached when we place a strong unshaded gaslight directly in front of the eye, and in close proximity to it. All the disagreeable and hurtful effect of strong daylight is produced upon the eye, without its immense diffusion and perfect steadiness. Sharp bright rays are darted into the eye when we look up, and a strong glare is kept on the eyelids of the downcast eyes. The flicker of the light keeps the diaphragm of the eye constantly trying to adjust itself to

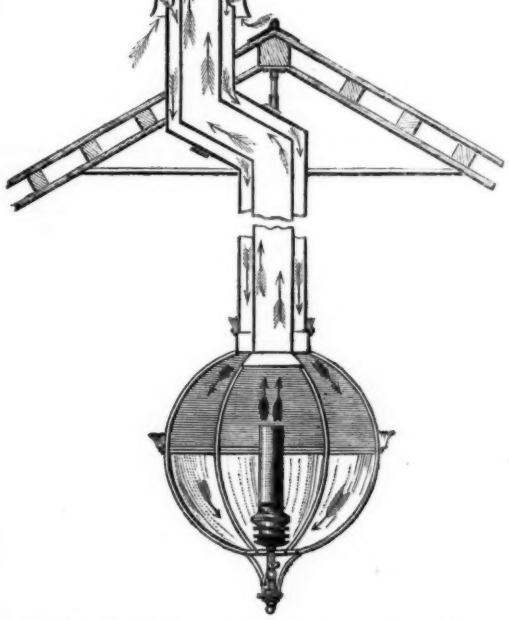
* Captain Abney, of South Kensington, has demonstrated that the red ray as well as the other rays can be photographed.

variable light, causing great fatigue. In addition to this, the heat of the lamp is thrown full on the front part of the head. Nothing is more contrary to the wise provision of nature, and therefore nothing is so sure to be deleterious to us. But this is the condition of things in relation to the artificial light which is used by our young girls and boys in their evening studies. Is it, then, to be wondered at that the eyes become prematurely old and insensitive—lose their brightness and all the fine perception of colour and form with which nature originally endowed them? It is useless to argue that there are instances of persons who have studied for years by the aid of artificial light, and still have good eyesight. Instances can as easily be found of persons who have done everything they possibly could to destroy their constitutions, and yet have not succeeded; but for one person who has not impraired his sight by the injudicious use of artificial light in pursuing his studies, thousands upon thousands have done so. I ask you to earnestly consider this fact—that if you give a high-class education to your children, and they impair their eyesight in gaining it, they waste all the great advantages of that high education, and are heavily handicapped in the race of life by the fact of their being obliged to wear spectacles. It is hardly possible to estimate the loss suffered by persons with defective eyesight during the course of their lives.

But you will naturally ask, What is the remedy for this state of things? I reply, a very simple and easy one. If you work by the aid of a candle, let it be a good one, and provide yourself with one of those little candle-shades, not opaque, but slightly translucent, of rose tint outside and white inside, so that a rose colour light falls on the eyes. If it is a lamp —either moderator or petroleum, but especially the latter—do the same thing, and, in addition, put a little curtain of pale rose paper or silk round the lower edge of the shade. Further than this, a screen of glass, paper, or other natural non-conductor of heat should be interposed between the head and the light, so that a current of air passes up between the light and the screen. The reason for it is this: Red stops the actinic ray. Clear glass is an impediment to heat, and also to a great extent to the actinic rays. The best light for drawing, writing, or reading is, therefore, in my opinion an Argand burner shaded, in the manner I have indicated, with a screen of ruby glass to protect the eyes from the actinic rays and heat of the gas. This is one of the non-actinic reading lights. [Lamp shown and explained.] Although, as you see, an exceptionally powerful light (equal to 30 candles), I find by repeated trials that persons who, as a rule, are unable from weakness of sight to read by any artificial light with comfort have been able to do so without fatigue with this strong light. For ordinary use such a light equal to 16 candles or so will be found best.

It is an important fact that Argand gas-burners with glass chimneys, though more powerful in light-giving properties with like consumption of gas than fishtail or flat-flame burners which are used without chimneys, are more useful in developing a soft and non-actinic light than the latter. Thus, for example, a flat-flame burner giving a light equal to 200 candles, will, with proper reflectors, enable a photographer to take a portrait in one minute; an Argand burner, equal to 400 candles, requires nearly the same time to take the portrait. The inference, therefore, is that the Argand burner with its chimney possesses only half the actinic power of the open flat-flame burner; and this is fairly borne out by the fact that in well-lighted rooms the photographic power of the outdoor daylight is diminished to more than one-half by the opposition of the glass in the windows to the entrance of the actinic rays.

Mr. Sugg then called attention to the complaints made about the heat and the alleged deleterious effects of the products of the combustion of gas on pictures, libraries, and museums, billiard-rooms, &c., and showed a drawing of a light suitable for a museum, picture gallery, or library. The light given by such an arrangement might be equal to from 100 to 1000 candles, and the products of combustion carried off, and the supply of fresh air to the lights brought in, without any communication with the room in which the lights were placed, and without altering the temperature of the room 1°. A small, closely-confined billiard-room at the Raleigh Club in London was, he said, now lighted by two of these lights, each light equal to 200 candles, and the temperature of the room was not increased in the least.



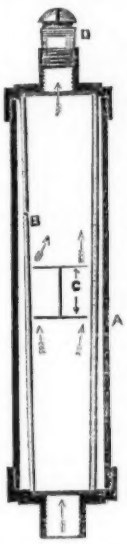
PATENT SELF-VENTILATING LIGHT, SIMILAR TO SOME IN USE AT ETON COLLEGE.

[The above engraving shows one of Sugg's Globe Form Self-Ventilating Lights for 100 or 200 candle burner. The lantern is of clear glass below, and white glass on the upper part; the two being divided by an ornamental fret, similar to that immediately above the globe, and surrounding the inlet and outlet flues. The outer or inlet flue—the outlet being contained within it—may, of course, be ornamented with any required design. The cold air inlet is shown immediately above the roof, and the currents of air in both directions are indicated by arrows.]

The lecture concluded by a reference to the use of gas in engines for obtaining motive power; in stoves for heating purposes; and, in its compressed state, for providing the means of effectually lighting railway carriages.

JOSLIN'S APPARATUS FOR ASCERTAINING THE HOURLY RATE OF GAS CONSUMED BY BURNERS.

This ingenious little apparatus, referred to in the above lecture, is the subject of a patent dated June 19, 1879 (No. 2428), the inventor being Mr. George Joslin, of Colchester.



The object of the apparatus is to provide the means of ascertaining the hourly rate of the consumption of gas in any burner—*i.e.*, the rate of consumption at the time of inspection calculated at the quantity that would pass in an hour at that rate—by showing in a glass or metal tube or case the position of a disc supported by the gas at a height corresponding to the quantity of gas being consumed.

The apparatus consists of a taper tube of glass, metal, or other material, of round or other form in horizontal section, and increasing upwards in area. Inside the taper tube is a thin disc or discs of talc, aluminium, or other material, and of the same form as the horizontal section of the taper tube. If one disc is used, it is maintained in a horizontal position by a piece of metal or other material attached to it; or two or more discs may be connected together. The taper tube is graduated to indicate the hourly rate at which the gas will pass the disc, and the gas being admitted at the bottom of the taper tube causes the disc to rise until it arrives at the figure which corresponds with the hourly rate of the gas passing. After the gas has passed the disc it flows from the upper part of the taper tube to the burners. The taper tube may be enclosed in a tube or case, and a rod may be attached to the disc, or other means may be used to indicate by figures upon a graduated scale the hourly rate of consumption; or the indicator and figures may be placed outside the tube or case before mentioned, and protected by a glass cover. The accompanying engraving shows a front sectional elevation of one form of the apparatus; A being a brass tube with an opening in front, so as to allow the position of the mica discs, C, to be noted. B is a glass tube, slightly conical, the larger end being uppermost; while D is the burner in position to be tested. The glass tube, B, is graduated so that the position of the discs, C, indicates the hourly consumption of gas.

SAN PAULO GAS COMPANY, LIMITED.

The Annual General Meeting of this Company was held at the London Offices, Pinner's Hall, E.C., on Friday, the 14th inst.—Mr. FREDERICK DELMAR, F.S.A., in the chair.

The SECRETARY (Mr. W. Southall) having read the notice convening the meeting, the following report was taken as read:—

The Directors have the pleasure to submit to the Shareholders the annexed statements of accounts for the six months ending Dec. 31, 1879, duly audited, which show that the total receipts for public and private lighting and rental of meters amount to £10,269 15s. 5d., as against £9464 2s. 11d. in the corresponding six months of 1878.

The net amount of revenue carried to profit and loss account for the half year is £3587 14s. 10d., which, added to the amount brought forward, £1847 0s. 6d. (after payment of the last dividend in October, £3817 10s., and deduction of £197 13s. written off Maud and Co.'s debt), makes a total of £5434 15s. 4d., out of which the Directors recommend a dividend to be paid for the six months at the rate of 10 per cent. per annum, free of income-tax, amounting to £3881 0s. 8d., and a further 20 per cent. (£158 2s. 6d.) to be taken off the balance of Maud and Co.'s debt, carrying forward at the credit of profit and loss £1395 12s. 2d. to the present half year.

Of the original issue of 7 per cent. debentures, there now only remain £1170 to be exchanged (at the option of the holders) for paid-up shares held in reserve. Of the second series debentures, £1230 have been paid off, and the balance (£1770) renewed for four years at 5½ per cent. per annum.

The Manager, under date of March 13 last, reported: "The public lighting has only been increased at present by 10 lamps, although 50 were sanctioned by the Legislative Assembly, the order for the erection of the remainder having been delayed by the Public Works Department. The city is increasing in a most extraordinary manner. Tramcars are running to nearly all the suburbs, and as the roads on this account have been improved, the people are clamouring for gas. It is only a question of time, and both public and private lighting must increase considerably."

The Gas Engineer's report on the works is highly satisfactory. After thoroughly repairing the houses, &c., he states the works, buildings, and machinery to be in a thoroughly efficient condition.

Two of the Directors, E. Batt, Esq., M.D., and S. F. Porter, Esq., retire by rotation, and, being eligible, offer themselves for re-election. The Auditor, Mr. Wm. Cash, also retires, and, being eligible, offers himself for re-election.

The CHAIRMAN, in moving the adoption of the report, said the Shareholders must regard the Company as being in a progressive state, this being their tenth annual meeting. He then referred to the difficulties against which they had had to contend in the first instance, the works not having been completed in the period stipulated, and afterwards alluded to his own services on behalf of the Company, to his correspondence with Ministers and other gentlemen, and to his efforts in bringing the Company to its present position. He did not look for remuneration, but worked from the pride he felt in advancing the welfare of the Company, in which many of his friends were interested, and in which he himself held £5000 of the shares. Just at the time when money was required and their financial difficulties were so great, the then Engineer, Mr. T. Rumball, brought forward a claim for £4000; but it was paid, as they thought it better at once to make an end of what they regarded as a bad job.

Mr. RUMBALL said it was an agreement when the Company was formed that he should receive that amount.

The CHAIRMAN said with regard to the manner in which the work had been done, their present Engineer wrote on Oct. 1 last that the Engineer's house had been for a long time sadly out of order, but that he had commenced to put it in thorough repair. He further stated that it was very badly put up in the first instance. On the 1st of February he wrote respecting the foreman's house, that he had commenced the work which was rendered necessary there. "It was in a very bad condition—in fact, it's a wonder how it held up so long." He urged them to keep out of the hands of engineers and contractors, who had been the ruin of a great many companies. They could, he said, manage the Company very well without. He referred the Shareholders to the good dividend the Directors were able to declare, and observed that it was remarkable that it was

not more. From what their Manager said, there was every prospect that it would be considerably increased. He made this statement to show that the Company had a right to congratulate themselves on the position they were in. With regard to the report, there was not a great deal to say, everything appearing to speak for itself. The item of general repairs in the revenue account was owing to the repairs to the buildings he had referred to. Printing and stationery figured for £88 17s., against £19 in the corresponding period of the year 1878, and the cause of the increase was that a very large number of account-books, circulars, gas bills, &c., had been sent out. The difference in exchange was considerable—£1057 as compared with £317 last year; but these were all things for which the Directors could not be held responsible. In about three years, however, it was found that the exchange equalized itself, and the good time was to come in this matter. As to the original debentures, there was only £1170 to be exchanged for paid-up shares which were held in reserve. There was also very little of the other debenture stock out, so the Company stood in a considerably more favourable position than they did. With regard to their funds, they had taken off 10 per cent. for depreciation, which he thought was a fair allowance. They had sent out a great many mains, but this was a gratifying expense, because it meant an extension of lighting, of which he believed there was every prospect. As to the stock of materials on hand and in transit, it stood at £12,690 in the balance-sheet, the total of which was £20,731; so there was on the other side certainly £7000 in the Company's favour. The item of £790 against Mauá and Co., the bankers, was still owing. The Shareholders might fairly conclude that this money would eventually be paid, and, if so, it would come as an agreeable surprise to them; if not, it would make them no worse off than they were at present. As to the imposition of duties, about £360 had been illegally charged the Company up to the present. The Manager wrote that he had represented to the Engineer Fiscal and to the President of San Paulo that if they continued to exact duties the Company could not extend the public lighting; but the President had received a letter from the Minister of Finance at Rio, refusing to allow materials to pass free of duty. The question of duties was with the General Government in Rio, and beyond the control of the President of San Paulo, who, however, had promised to see all back accounts owing by the Provincial Government satisfactorily settled. He feared there would be no recovery of the duties illegally charged without diplomatic interference. This he (the Chairman) intended to try to obtain. With regard to the public lighting, as the amount paid for this came from the general revenue of the province and not from municipal sources, the people outside the city were obliged to contribute; but as they derived no benefit they naturally objected to any increase in public lighting expenditure, and any increase was obtained by the President from the Legislative Assembly with great difficulty. From 300 to 500 extra lamps were required to light the city and suburbs well. The Company's Manager wrote on March 13: "The public lamps have been increased by ten. Fifty were sanctioned twelve months ago, but the Public Works Department have delayed giving orders to erect them. I have reasons to believe that on account of public pressure further extensions will be made in the next few months." On March 22 he wrote as follows:—"In about ten days the public lamps will be increased by eleven. Pending further orders from the authorities, we purpose extending the mains to several outlying districts, in order to supply private houses that are already fitted up in anticipation of the extension of public lighting." The Company paid as they went on, and, this being so, there was, he said, no occasion for reserves. They thought, as they were paying as they went on out of revenue, the money that remained belonged to the Shareholders. With regard to private lighting, in the present year there had been a marked difference, and they were very busy putting in services and fixing meters. The city was increasing in an extraordinary manner. This supported the statement he had already made, that the Directors had every reason to believe they would have a rapid increase in the revenue. The public appeared to be well satisfied with the quality of the gas which the Company supplied to them. There were some complaints about the price charged, as it now fluctuated with the exchange. This was, however, unavoidable. The loss of gas from leakage, condensation, &c., was now small. In order to show how the Company were progressing, he would remind the Shareholders how the concern had been going on since 1876. In that year the gross income was £16,971, and the net profit was £3801; in 1877 the gross revenue was £17,727, the net profit being £5214; in 1878 the gross revenue was £19,455, and the net profit amounted to £7089; and in 1879 the gross revenue was £23,461, while the net profit was £7816. Thus, as they would see, there had been a gradual progress. The increase in the net profit last year was not in the same ratio as before, but there were the expenses that year for repairs, and the greater difference in exchange. This accounted for the proportionate decrease in the net profits, but the increase in the gross revenue was on the same scale as before. Their Engineer reported that every thing in the general way was going on as well as could be wished and all the staff under his superintendence were giving every satisfaction. Speaking as a Shareholder as well as a Director, he (the Chairman) was perfectly satisfied with the position of affairs, as to which the Shareholders now knew all that he knew. If not, there were the books of the Company, and he would be happy to reply to any question. In reply to an inquiry, he added that their Gas Engineer, who was a very able man, sent the Directors reports every month by the mail.

A SHAREHOLDER said that the difference in the loss by exchange between the half year under review and the corresponding period of 1878 appeared from the accounts to be about £700, but the Chairman had said that the price of gas fluctuated according to the rate of exchange. If that were so, why should the difference in the exchange appear?

The CHAIRMAN said it was not a real loss. It was mentioned in order to call attention to the matter, and it had some influence on the sum total.

Mr. RUMBALL requested that the minute-book might be produced, to show that the arrangement by which he was to receive £4000 was stated therein, Mr. Delmar being present at the time. An erroneous impression had been produced on the meeting, and he desired that it might be removed.

The SOLICITOR (Mr. Batten) urged that the meeting might be conducted in order, and suggested that the first thing to be done should be the adoption of the report and balance-sheet, which the Chairman would move.

The CHAIRMAN then moved, and Mr. S. F. PORTER seconded, the motion for the adoption of the report, and it was carried, and the dividend therein recommended declared.

Some discussion having taken place as to the retention of Mr. R. Clay as an "Honorary Director,"

Mr. SANVILLE moved, and Mr. HEARNE seconded, the re-election of the retiring Directors, and the motion was carried, as was also one re-appointing Mr. W. Cash, the Auditor.

Some further discussion then ensued as to the appointment of Mr. Rumball to a seat at the Board in place of Mr. Clay; but, on a show of hands being taken, the meeting was found to be in favour of the Board as then constituted. A poll was, however, demanded, and the result was that a considerable majority was opposed to Mr. Rumball's election.

The meeting closed with the usual compliment to the Chairman.

BOMBAY GAS COMPANY, LIMITED.

The Ordinary Half-Yearly General Meeting of this Company was held at the London Offices, Drapers Gardens, E.C., on Thursday last—D. T. EVANS, Esq., in the chair.

The SECRETARY (Mr. W. Marshall) read the notice convening the meeting, and the following report of the Directors was taken as read:—

Your Directors have pleasure in submitting to the Shareholders a statement of accounts, duly audited, for the half year ending the 31st of December last.

There has been an increase in the gas and meter rental, as compared with the corresponding half of last year; but in the cost of production there has been a slight increase. The returns from coke and tar show a small decrease.

Considering the continued stagnation of trade in Bombay, your Directors think it a matter for congratulation that the consumption of gas and the profit thereon have been so fairly maintained.

The loss on exchange during the half year was £2714 14s. 2d. This sum, with that previously standing at the debit of exchange equalization account—viz., £2609 11s. 7d. —makes a total of £5324 5s. 9d. to be provided for. Of this the Directors have charged £2200 to profit and loss account, and £3124 5s. 9d. to the reserve-fund (equalization dividend account), thus writing off the whole loss. The Directors had less hesitation in adopting this course, forasmuch as there have been during the current half year no remittances from Bombay, and consequently no loss on exchange. This, it is expected, will enable them to provide a considerable amount in the current half year, either for appropriation to the reserve-fund (exchange equalization account), or to meet any loss on exchange in the latter half of the year.

The amount at the credit of profit and loss account for the half year is £9547 19s. 9d.; which, with the balance brought forward, £157 12s. 11d., makes a total of £9705 12s. 8d. Out of this your Directors recommend a dividend of 4 per cent. (making 7½ per cent. for the year), free of income-tax. This will absorb £9600, leaving £105 12s. 8d. to be carried forward to the next half year.

The Local Audit Committee commenced their duties in October last, and are performing them with zeal and efficiency.

Your Directors have removed the offices of the Company to 6, Drapers Gardens, Throgmorton Avenue, E.C., whereby, whilst sufficient accommodation is provided, a saving has been effected in rent and outgoings.

The Directors who retire by rotation are William Swainson Suart and Warine Bayley Marshall Lysley, who, being eligible, offer themselves for re-election.

The Auditors, Edward George Bradley and Robert King, retire from office, and, being eligible, offer themselves for re-election.

General Balance, Dec. 31, 1879.

Dr.				Cr.			
Capital authorized—(50,000 shares, at £5 each—£250,000.)				Construction account		£203,396	12 10
40,000 shares, £5 paid	£200,000	0	0	Retort account		1,532	9 9
10,000 shares, £4 paid	40,000	0	0	Services account		76	12 6
	£240,000	0	0	Goods in transit		2,136	14 10
Amount owing by the Company	2,978	11	6	Stocks, viz.—			
Reserve-fund (equalization div. acc.) £3,435 18 5				Chandeliers, brackets, &c.	4,483	1	1
Written off for loss on exchange 3,124 5 9				Brass and iron goods	5,154	18	5
	311	12	8	Mains, services, and tools	1,895	2	4
Reserve-fund (for depreciation of plant, &c.) £3,218 12 7				Meters	2,945	5	2
Written off 442 18 6				Coal	7,725	6	6
	2,775	14	7	Residual products	149	5	7
Insurance-fund	1,800	2	3	Amount owing to Company	5,863	13	8
Passage-fund	177	2	2	Invested funds — Victoria Government 4½ per cent. Debenture Railway Loan, 1878	1,842	15	0
Balance to general revenue account	9,705	12	8	Cash at Bankers, on deposit, and in hand, viz.—			
				In Bombay. £3,968 11 0			
				In London 6,441 16 9			
				Bank bills in hand 10,226 10 5			
					20,636	18	2
	£257,838	15	10		£257,838	15	10

Profit and Loss Account, for the Half Year ending Dec. 31, 1879.

Coal carbonized	£7,407	14	8	Gas and meter rental	£20,098	1	5
Wages	1,202	17	5	Coke, tar, fittings, &c.	3,611	16	8
Purifying	14	19	10	Interest	68	17	11
Trade and general charges	704	5	10				
Salaries and Collectors commission	1,621	12	1				
Rents, rates, and taxes	420	9	3				
Directors & Local Audit Committee's remuneration	638	15	0				
Bad debts	12	14	4				
Law charges	7	7	10				
Exchange account	2,200	0	0				
Balance	9,547	19	9				
	£23,778	16	0		£23,778	16	0

General Revenue Account, Dec. 31, 1879.

Balance carried down	£9,705	12	8	Balance, June 30, 1879	£8,557	12	11
				Less dividend paid Dec. 1, 1879	8,400	0	0
					£157	12	11
				Balance for half year ending Dec. 31, 1879	9,547	19	9
	£9,705	12	8		£9,705	12	8
				Balance for appropriation	£9,705	12	8

The CHAIRMAN: I am ill, and must, therefore, ask your indulgence. I have been Chairman of the Company from its commencement—it is now in its nineteenth year—and during this period I have presided at each annual meeting, and I may say at each half-yearly meeting. The accounts are before you, and they speak for themselves. I will not attempt at this moment to go through them; but if any gentleman has any question to ask, and will kindly put it, it will be answered. At the close of the last annual meeting I made this remark: "We shall not do very brilliantly this year, but I think we shall be able to maintain the dividend." Events have justified that prediction. We have been able to maintain the dividend, but not without difficulty. The gas and meter rental shows an increase of £231. This is not much, but it is reassuring in this sense, that if you look at the great depression of trade which has existed in Bombay, and the necessity there has been for economy, and observe the suspension of the public works, I think it is not unsatisfactory that we have maintained the gas and meter rental, and have made a small increase, such as it is. In the item of coke, tar, and fittings, which for obvious reasons we group together, a decrease is shown of £150. With respect to coke, we have not done so well this year as we could have wished, and there are various reasons for it. Very strong allies and supporters of ours are the lime-burners in and around Bombay, but during the past six months these have been no consumers at all. The public works, and notably the drainage system, were at an end, and we have had no support or assistance from them. We have, therefore, only had to look to the general public for the consumption of our coke. We have done all we possibly could in the matter. We have been encouraging the consumption of coke in small coke-stoves, and these are coming more or less into use. The leakage upon the year is small, being below 8 per cent. The item of coal, of course, is most important, indeed it is almost the basis of our property. The coal carbonized during the year has been slightly dearer, but the increase is not a very serious matter—£1 14s. 7d. in 1878, as against £1 15s. 7d. in 1879. We have now in stock a twelvemonth's supply. We chartered

two steamers in January last, the freight being low, and the tonnage wanted on the other side—to go through the Canal—with English coal. The English coal has a disposition to fire, but in the Australian coal there is not that disposition. We had suffered by this, and, profiting by our experience, we directed English coal to be used as soon as it arrived. By this means we avoid the risk of firing. That has been an experiment which has been followed with excellent results. We get from it a considerably larger tonnage of coke. Last month's returns showed an increase of 50 tons. I now come to the matter of the exchanges. I hope the Shareholders will be satisfied with the mode in which we have dealt with the matter of the exchanges. We were most anxious not to reduce the dividend, and I hope the course we have adopted will meet with approval. With respect to the current half year, inasmuch as we bring no money home, we shall incur no loss, and we have a very large sum in hand on the other side—about £12,000, bearing 5 per cent. interest, and we are waiting and watching a favourable moment in the exchange to bring it home. We hope during the current year to build up the reserve-fund to what it was before. I do not know that I have any more remarks to make, except this, that the prospects of the exchange are slightly improved. There is a loan of three millions being raised in Calcutta, and it seems probable the greater part of it will be subscribed on this side. There is also a hope that the weekly Council drawings will be either suspended or diminished; and, indeed, they are now being diminished. Business is reviving again in Bombay. The new docks are opened, and we shall have, as I hope, a considerable increase in the consumption of our gas there. The docks, Major Suart informs me, have been lighted, and there is a resumption of all public works. I may give this assurance to you, that the consumption of gas is increasing, in that there are more private lights now than we have ever had, numbering, in fact, over 17,000. With these remarks, and in the hope and belief that we shall do very much better this half year than we have done during the past half year or year, I will close my remarks by moving the adoption of the report and the statement of accounts, including the declaration of a dividend of 4 per cent. for the half year.

Major Suart seconded the motion.

Mr. Northover thought it was satisfactory that the Company lost £260 less than before by the rate of exchange. The rupee might be regarded as worth 20d., and he did not suppose it would go much higher. He did not think the Shareholders had much to complain of. He considered the Board had acted wisely in declaring the full dividend. The reserve-fund was not entirely wiped off, though it was reduced. On the other hand, he thought it was always best to meet any difficulty in the face. He noticed that, so far as coal was concerned, the stock was now £7725 against £18,749 this time twelve months ago. This had been in a measure already explained, and therefore the Shareholders were alive to the interests of the concern. As to the old "bogey," the electric light, which used to trouble them, he saw the other day that its brilliancy caused the loss of a vessel. *The Times*, too, was taking a different position. Formerly it was not "a clear stage and no favour;" it was in favour of the electric light; but now it seemed to have come round to a clearer view that, after all, there was not so much in electricity as was at first thought. The Shareholders, therefore, had nothing to fear on this score.

The Chairman: The Marquis of Ripon is on his way to India, and on his arrival there will, no doubt, be some festivities at Bombay, which will cause much gas to be used. During Sir Richard Temple's governorship we lost nearly all the lighting of the Government House, through his not residing at it. We hope the gentleman who is now going out will be more resident. In reply to an inquiry, he added that the Company were fully insured on this side—the fittings and buildings, but not against explosions.

Mr. Wylde remarked that only three or four bad explosions had taken place since gas companies had been established.

Mr. H. P. Stephenson said as regarded fire insurance it would be a very heavy cost to insure all the Company's works. They did not know which was going to explode, and they could not "spot" the exact one. In his experience, he had known only a dozen explosions in gas-works, and he should almost call them all bad ones; but Mr. Wylde meant as regarded the amounts. The great difficulty was to "spot" the place where the explosion was going to occur. If it was intended to spread the insurance over the whole of the buildings, the cost would be enormous—it was about 10s. per cent. As to the electric light, Mr. Northover had raised the question, and he (Mr. Stephenson) merely wished to mention one matter to the Shareholders, which he thought they would consider a little interesting. He was Deputy-Chairman of the Crystal Palace District Gas Company, and some short time ago the Crystal Palace was lighted up with the electric light, and about a month after, to their astonishment, it had caused an increase in the gas bill of 30 per cent. That arose in this way: The light was so intense in the nave that all the other parts of the Palace were thrown into a great amount of shade, and the eye, accustomed to the intense light in the nave, could not see in the dark unless the gas were turned up as high as possible; and thus it added to the Company's gas bill. He believed that the electric light had now been taken away from the Palace. The Chairman had not mentioned that the Directors had received advices that the price of coal in Australia had been reduced from 13s. and 13s. 6d. down to 10s. a ton. At present there was a probability that it would go even lower. A fall of 5s. a ton on their coal—and most of it came from Australia—would be something important as regarded their profits, seeing that they used about 8000 tons. He quite agreed with Mr. Northover that it was not desirable to reduce the dividend until the Directors saw that they were really driven to it, and for this reason they had been using the reserve-fund to make up the increased loss on the exchange.

Major Suart observed that a loss on exchange must still be looked for.

The motion was put, and carried unanimously.

The retiring Directors and Auditors were then severally re-elected.

Mr. Wylde said it was most important that the audit should be well done in Bombay.

The Chairman replied that the Company had a very excellent Audit Committee in Bombay, and they were giving the Board the greatest satisfaction.

Mr. Northover moved a vote of thanks to the Chairman and Directors, and in doing so expressed a hope that they would continue to do in the future as they had done in the past—their best to promote the interests of the Shareholders. The Company had passed through certain difficulties, and he believed that, at any rate, they were not going to have worse times in the future, but, on the contrary, were likely to improve.

The motion was carried unanimously.

The Chairman, in returning thanks, expressed his acknowledgments to Mr. Northover for his kind remarks. He was quite sure that the Directors would do their duty in the future, and the Shareholders might rely on this from their conduct in the past. His brother Directors and himself had all of them acted zealously, conscientiously, and honestly in the service of the Shareholders.

Mr. Northover then moved a vote of thanks to the Secretary. He would not eulogize that gentleman in his presence, but he was entitled to say that whenever he (Mr. Northover) called at the office, he was most courteously received, and that every explanation was given him. He should also like to mention the names of the Engineer and Manager in Bombay.

The motion was put, and carried unanimously.

The Secretary acknowledged the compliment, and the proceedings then terminated.

NICTHEROY (BRAZIL) GAS COMPANY, LIMITED.

The Twelfth Annual Meeting of this Company was held at the London Offices, Great Winchester Street, on Thursday last—Mr. H. L. Micholls in the chair.

The Secretary (Mr. W. W. Wright) having read the notice convening the meeting, the following report of the Directors was taken as read:—

The Directors submit herewith the accounts for the year 1879, duly audited. They think they may fairly congratulate the Shareholders upon the working of the past year. The Manager, Mr. Martin, has shown himself most attentive and capable, and the increased production of gas per ton of coal, the reduction in the amount of fines, and the better state of the works, prove that the change necessitated by the death of the late Manager has been of service to the Company.

The revenue shows a balance of £4324 17s. 1d., after deducting all bad debts, providing for doubtful ones, and putting £1000 to reserve, and £500 to a sinking-fund to pay off outstanding debentures. A dividend of 3 per cent. was paid in September last, and the Directors recommend the payment of a further dividend of 3 per cent., making 6 per cent. for the year, and leaving £437 17s. 3d. to be carried foward.

Mr. Edward Gotto is the retiring Director, and, being eligible, offers himself for re-election.

The Auditors, Messrs. Price, Waterhouse, and Co., retire, and offer themselves for re-election.

Dr. *Revenue Account, for the Year ending Dec. 31, 1879.* Cr.

Manufacture of gas—				Gas supplied—			
Coals carbonized		£3,722	9 2	Public lamps		£10,628	18 6
Purifying materials		50	2 10	Less fines		23	7 9
Salaries and wages		1,724	10 11			£10,605	10 9
Repair and maintenance of works		434	15 11	Public buildings		391	6 7
Distribution of gas—				Private consumers		3,631	14 0
Salaries and wages		713	12 1	Residual products		1,389	19 7
Repair, &c., of mains and service-pipes		57	19 0	Fittings		133	18 6
Lighting and repairing public lamps		1,079	2 3	Transfer fees, &c.		3	14 1
Management—				Gain on exchange		341	12 11
Directors remuneration		500	0 0				
Agency in Brazil		441	8 2				
Honorarium to Concessionaire		250	0 0				
Bonus to Manager		100	0 0				
Collection		170	14 5				
Office expenses (England and Brazil)		370	3 4				
General expenses (England and Brazil)		111	3 4				
Auditors		21	0 0				
Taxes (England and Brazil)		167	14 4				
Fire insurance-fund		100	0 0				
Bad debts		71	7 1				
Reserve for doubtful debts		300	0 0				
Sinking-fund to pay off debentures		500	0 0				
Interest on debentures		274	3 4				
Interest		12	13 2				
Carried to reserve for depreciation and cost of concession		1,000	0 0				
Balance, being profit for the year		4,324	17 1				
		£16,497	16 5			£16,497	16 5
Interim dividend, 1879		£2,547	14 8	Balance brought down		£4,324	17 1
Balance of revenue, Dec. 31, 1879		2,985	13 5	Surplus of revenue, 1878		1,208	11 0
		£5,533	8 1			£5,533	8 1

The Chairman, in moving the adoption of the report, said he regretted that there was not a larger attendance, in order that he might speak more hopefully of the undertaking to a greater number of Shareholders. The accounts of the Company for the past year he thought he might say were decidedly more satisfactory than those of the previous year, and it was with great pleasure that for the present year he could speak even more hopefully than he had ever done since he had been Chairman of the Company. He did not consider that the Company was one of the most successful concerns going, but since the appointment of the new Manager, although the business had not increased, yet by his careful management, and by the great attention the Directors had given to the accounts and to general economy, they had been able to reduce the expenses considerably, and also to make a very much larger quantity of gas, per ton of coal carbonized, than had ever been produced before. In consequence of this, although really and truly very much more money had not been received from the absolute sale of gas, there was a larger profit realized than had ever been made since the Company had been in existence. The accounts spoke for themselves, and showed that this year there was a clear balance of profit. After placing £1000 to the reserve-fund, setting aside £500 to pay off the debenture debt, charging all the bad, and providing for the doubtful debts, there was still £4324 as the profit of the year, which really, considering what had been previously done, was, he thought, quite a satisfactory way to look at the Company's affairs. The Manager, as would be seen, had gained his agreed bonus of £100, which proved at once that he had given the proper attention to his work. He (the Chairman) was certain all the Shareholders would feel this to be a satisfactory arrangement—that the Manager should participate in the well-being of the Company. They really had to be thankful for him, as he had been found to be an earnest, intelligent, and able man, and he (the Chairman) could congratulate the Shareholders on having secured Mr. Martin's services. The Company was in a much more satisfactory condition than it had ever been before, and he could only trust that with the same attention that had hitherto been given to it, and with the same condition of affairs that had existed during the past year in the present year, things will go on quite as well; and that when he next had the pleasure of meeting the Shareholders there might be a better report to offer them than that which he then had to propose for their acceptance.

Mr. Gotto (a Director), in seconding the motion, said he had only to add to the remarks made by the Chairman that it appeared to him to be a very wise course to devote so large a proportion of the profits to the reserve, and he believed that those who survived to see the end of the Company's concession would find that their reserves had amounted to 33 per cent. of the capital. He thought, if the Company continued in the course they had been pursuing, it would be likely to place them eventually in a very satisfactory position.

The motion was put, and carried unanimously.

The Chairman then moved the declaration of a 3 per cent. dividend for the half year ending Dec. 31. He had no doubt this would be acceptable to the Shareholders, and the Company could fairly pay it. A slightly larger dividend might have been paid, but not with the same amount of safety that the Directors could propose the present one. He felt satisfied that the Shareholders would be pleased with this distribution, and would

think the Directors had acted with judgment in doing as they had done with the accounts.

Mr. MARTINEAU seconded the motion, and it was carried.

The retiring Director and the Auditors were then re-elected, and the proceedings terminated.

STAFFORD CORPORATION GAS SUPPLY.

We have received from Mr. John Storer, the Manager of the Stafford Corporation Gas-Works, a copy of the accounts of the gas department for the twelve months ended the 25th of March last. The capital account is made up as follows:—£4983 6s. 8d. of the late Gas Company's debenture bonds at 4½ per cent.; £53,585 3s. and £3450 of Corporation mortgage and debenture loans, bearing interest at 4½ and 4 per cent. respectively; and £14,150 of perpetual annuities at 4 per cent. The fixed plant was valued at £78,215, an addition of £832 having been made during the past year. The following is the

Dr. *Revenue Account for the Year ended March 25, 1880.* Cr.

Manufacture of gas—				Sale of gas	£10,520	15 0
Coals, including dues, &c.	£3,510	16 11		Public lighting and under contracts	1,103	1 0
Purifying materials, &c.	106	6 2		Rental of meters	524	10 5
Salaries of Engineer, Superintendents, & Officers at works	450	0 0		Residual products—		
Wages and gratuities at works	677	11 2		Coke, less labour and cartage	506	10 4
Repair and maintenance of works and plant	1,180	5 7		Tar, do. do.	775	3 8
Distribution of gas—				Ammoniacal liquor	253	7 7
Salaries of Inspectors, &c.	96	0 0		Refuse lime	18	6 2
Repair, maintenance, and renewal of mains and service-pipes	328	2 11		Rents	27	0 0
Repairing, renewing, and refixing meters	211	16 5		Fitting and service-laying account	20	8 0
Lighting and repairing public lamps	340	8 5				
Rents, rates, and taxes	411	12 10				
Management	226	14 9				
Depreciation-fund	728	3 0				
Bad debts	67	16 3				
Total expenditure	£8,335	14 5				
Balance carried to profit and loss account	5,413	7 9				
	£13,749	2 2			£13,749	2 2

Dr.—*Profit and Loss Account (Net Revenue).*

To Income-tax	£105	5 8	
Interest on temporary loans, accrued to March 25, 1880	78	13 0	
Interest on loan, accrued to March 4, 1880	2,259	15 5	
Interest on debenture bonds, accrued to Dec. 31, 1879	219	11 5	
Interest on perpetual annuities, accrued to March 25, 1880	566	0 0	
Interest on loans on debentures, accrued to Dec. 31, 1879	127	8 11	
		£3,356	14 5
Balance	£842 5 9 / £2,056 13 4	2,898	19 1
		£6,255	13 6

Cr.—*Profit and Loss Account (Net Revenue).*

By Balance of net profit, brought from last account, March 25, 1879	£2,342	5 9	
Less general district fund—amount transferred in reduction of rates	1,500	0 0	
		£842	5 9
Revenue account balance, being profit for the year ending March 25, 1880		5,413	7 9
		£6,255	13 6

PROPOSED EXTENSION OF THE OVER DARWEN GAS AND WATER WORKS.

LOCAL GOVERNMENT BOARD INQUIRY.

The Town Council of Over Darwen having applied to the Local Government Board for sanction to borrow £16,000 for works of sewerage and street improvements, £6600 for gas-works extensions, and £2270 for works in connection with the water supply, Mr. S. J. SMITH, C.E., one of the Board's Inspectors, held an inquiry at the Town Hall, Over Darwen, on Tuesday, the 18th inst., when the Mayor (Alderman Snape, J.P.), the Town Clerk (Mr. C. Costeker), the Borough Surveyor (Mr. Stubbs), the Gas Manager (Mr. T. Duxbury), and several members of the Town Council, were in attendance.

The TOWN CLERK said the application to borrow £16,000 for sewerage and street improvement purposes was really made with the object of obtaining funds to put in thorough repair the main street of the town. The Corporation, however, only required £15,000 for this purpose, as they could now borrow £777 2s. 3d. under the special powers obtained last year in the Over Darwen Improvement Act; so that they proposed to ask the Local Government Board's sanction to borrow £15,000. He might add that the Corporation had recently taken in a considerable area, part of the township of Lower Darwen, which had no sewerage at all. With regard to the application for a loan of £6600 for gas-works purposes, he explained that £1450 was required to complete a new gasholder. The Corporation already had the sanction of the Local Government Board to borrow £15,000 for the new holders, but since that sanction was obtained they had extended the district so as to include part of Lower Darwen, which was formerly supplied by the Blackburn Corporation. They purchased the plant, but did not take into consideration that they would have to lay out a considerable sum of money in providing larger pipes, and in extending the mains. This item alone came to £3240. The mains were of various sizes, from 4-inch upwards. The additional plant they had had to put up had cost £135; making tight the old well for holding tar and ammoniacal liquor, £88; and 100 new lamp-pillars for lighting the district, £300. These items made up the £6600. As to the loan of £2270 for works in connection with the water supply, he explained that one part of the district was not supplied with water at all. The residents in that locality, being part of the borough, had made application to the Corporation to be supplied with water, and the Corporation now proposed to construct a small reservoir and supply them, at a cost of £600. Hoddlesden, the place in question, was within the Corporation's water district, and they proposed to take the water there by means of a 24-inch iron main from their present reservoirs, at a cost of £1400. The small reservoir was intended to supply the higher end of the town. The Corporation had some land of their own, and a valuable spring of water, which they intended to utilize by means of a small tank, just for the purpose of supplying a few houses at the upper end of the town. The water came from a spring, and supplied one or two private houses, but the overflow went into the brook and flowed down into Lower Darwen.

Mr. STUBBS said that the capacity of the proposed reservoir was 44,856 gallons.

Mr. DUXBURY remarked that it was proposed to spend £150 upon it.

The INSPECTOR said he did not think they would be able to construct it for this amount. He thought they had better add another £100 or £150 to the cost.

The TOWN CLERK said there was an item of £636 6s. for the extension of pipes in the district. It was proposed to have 739 yards of 6-inch, and 920 yards of 4-inch mains; and there was another item of £35 for new fire-plugs.

The MAYOR stated that the Corporation proposed to construct a line of rails from the Lancashire and Yorkshire Railway to the gas-works in the town, and he did not know whether the Inspector would entertain the question or not, as the Corporation had not made any formal application about the matter. It was for the purpose of bringing down coals to the works, and taking away some of the residuals, and they proposed to expend about £3000 upon it. If constructed, it would be the means of relieving the streets of a good deal of traffic.

The INSPECTOR said there would have to be another inquiry, but he would have some further talk over the matter with the Mayor. He proposed to look round the district, and he would report to the Local Government Board in due course.

The proceedings then terminated.

STOCKTON AND MIDDLESBROUGH CORPORATIONS WATER SUPPLY.

At the Quarterly Meeting of the Middlesbrough Town Council, on Tuesday, the 11th inst.—the MAYOR (Alderman Imeson) in the chair—the half-yearly report of the Water Board was presented.

Alderman BELL moved the adoption of the report, which contained the reports of Messrs. M'Kay and Co., the Board's Auditors, and Mr. Radford, the District Auditor, which latter we gave in the JOURNAL of the 20th ult., p. 603, together with a resolution of the Board relative to the latter gentleman. The statement of accounts showed the fluctuations in the items of revenue during the half year ending Feb. 14, as compared with the preceding half year. In Stockton there was a total decrease of £306 4s. 11d., made up as follows:—Domestic water-rents, £169 18s. 1d.; water supplied by meter, £100 9s. 7d.; and sundries, £35 17s. 3d. In Middlesbrough the domestic water-rents indicated a decrease of £777 15s. 10d.; but the water supplied by meter showed an increase of £916 14s. 2d., and sundries £45 11s. 6d.

Mr. MILDRED asked if £4000 written off in one year for allowances, discounts, and bad debts was not excessive.

Mr. J. STEVENSON said the Council were very glad to receive the report, and were especially indebted to Mr. Radford, who had presented in a very simple form the cost of acquiring the property of the old Company. He had noticed a minute passed by the Water Board, which he supposed was intended to be complimentary to Mr. Radford; but it did not go so far as the Council would like, seeing that they were getting information they had not hitherto possessed. Mr. Radford had traced the cost for the first seven months, and it was £842,296; but the capital expenditure up to the 10th of February was £853,234 13s. 10d., being £8796 for extension of the works under the Act, and £2142 which had been spent and must be added to the cost of acquiring the property. Reverting to a report by the Chairman of the Board, which was included in the Board's report, the Chairman said the net revenue for the half year was £14,465, as compared with £15,187 in the previous half year. The gross receipts showed a falling off, while the expenditure had increased £571. It seemed to require some explanation as to why the expenses were £1000 a year more than the average expenditure of the Company. Increasing the charge for water 25 per cent. did not add to the cost of collecting. As to the financial position of the Board in February last, £12,980 due to the bankers was paid off by the precept for £5000, £1203 received from the Corporation in advance for work in hand, and £6777 out of current water-rates collected in advance. Each Corporation contributed £5000 out of the rates. He did not notice that anything was written off for depreciation of plant. If they took the annual net revenue at £29,652, it would give them £3 9s. 6d. per cent. interest on the capital—£853,234—which, if they could borrow the whole of it at 4½ per cent., would leave a deficiency of £1 0s. 6d. per cent., or £8745 per annum, the amount to be taken out of the rates of the two towns.

Mr. ARCHIBALD said Mr. Radford had given them some valuable information, and they were obliged to him for it. He (Mr. Archibald) never before heard that so ridiculous a sum as £5 was offered for the water-works.

Mr. BARRITT asked how much was still owing to Mr. Mansergh, the Water Board's Engineer. They had paid £37,000 for surveying and boring, £4500 for engineering, and £13,000 to lawyers.

Alderman BELL said he only asked the Council to accept the report. As to Mr. Mildred's question regarding the somewhat irregular mode of dealing with the allowances, the matter had been left too much to collectors. But the Board's attention had been called to it, and he thought it would be found the allowances were decreasing. During the past two or three half years there had been considerable difficulty in collecting any rates. The chief cause of the allowances being large was the difficulty of getting in rates, and then there was the irregular mode of collecting. He was glad the report had received so much attention. Mr. Stevenson had gone through the accounts with some trouble, and he was a good deal astonished to hear him say the first information giving particulars of the cost of acquiring the water-works undertaking was contained in Mr. Radford's report. The Board's last half-yearly report contained exactly the same information as Mr. Stevenson professed he had obtained from Mr. Radford. It was the endeavour of the Board to place before the Corporations, in as complete a form as possible, all the information at their disposal. The capital had been well ascertained for some time, and the whole of it had been paid except £23,000. As to depreciation, there was a sinking-fund provided for by the 1876 Act, and would be made even more stringent by the Provisional Order which the Corporations were applying for. Mr. Stevenson hoped they would borrow at 4½ per cent. He (Alderman Bell) hoped they would do better, but this was a matter for the Corporations, and no doubt they did the best they could. In reply to Mr. Barritt, he might say there was a distinct agreement with Mr. Mansergh, by which a certain sum of money was due to him. He had received £2700 on account, and now he was being paid £1000. £1700 was still due to him. In due course the account would be all liquidated, and then he hoped there would be no further account until trade justified the Board in going on with the works in the upper reaches of the Tees. He should like to say a few words in regard to Mr. Radford. The Water Board thought fit to pass a resolution, and he, as Chairman, was obliged to give effect to it. Mr. Radford's report laboured under disadvantages. He put down the sum of £37,000 for surveying and boring, which was obviously incorrect, but he (Alderman Bell) had no means of checking it. The Council had better let the matter rest for the present, and not condemn the Board without having all the facts they possessed.

Alderman DUNNING said that the £37,000 was made up of the Company's as well as the Corporations charges for surveying and boring.

Mr. STEVENSON said he should like to disclaim all idea of complaining of

the accounts. His object was to draw certain deductions, and, as he understood, the Chairman of the Board had not questioned any of his figures. As to what the Council received some time ago, he did not know. He only quoted from the report before them, and had never seen the figures given before; but he might add that they seemed new to the majority of the Council.

The report was accepted.

Mr. RAYLTON DIXON then moved—"That this Council expresses its dissent from the minutes of the Water Board relative to the report of the District Auditor, and considers that it is indebted to that gentleman for having called the attention of the Board, and through it the Corporation and inhabitants of the borough, to the very important facts in connection with the acquisition of the water-works and the expenses incurred in carrying out the scheme."

Mr. WALTON seconded the resolution.

Mr. ARCHIBALD said that if the figures were inaccurate no such resolution ought to be passed.

Mr. DIXON said that as the Water Board had not raised any question about inaccuracy, the Council had a right to assume the figures were correct. It was a wrong policy to endeavour to "squash"—to "sit upon" a report because it was not palatable. It was better to have all the facts. The water-works had been obtained at a fearful sacrifice, and all the facts were wanted by the public.

Alderman BELL did not know what meaning was attached to the words "squash" and "sit upon," but if they meant that the Board wished to hide, to suppress information, they were as inapposite as they were inelegant.

Mr. MILDRED observed that the Council had had the benefit of Mr. Radford's report, and that he saw no advantage in censuring the Board.

Mr. HANSON said he intended to support the resolution, as he gathered from the Board's report that their desire was to snub Mr. Radford for having done something in excess of his duty. But he had given to the public in regard to the water-works—that unfortunate undertaking—certain figures in a clear tabulated form, such as the public had not seen them in before.

Mr. J. A. JONES thought Mr. Radford had exceeded his duty in expressing an opinion on the policy of the Board, but his figures were so valuable that he ought to be thanked for them.

The motion was then put, and carried by 14 votes to 7.

The meeting then terminated.

SOME NOTES FROM AMERICA.

(FROM OUR OWN CORRESPONDENT.)

The gas affairs of the Metropolis always receive a very liberal share of attention in your JOURNAL, which is natural enough when the immensity of the interest is taken into account; nor is it to be wondered at if, when writing of gas matters from this side of the Atlantic, I deal principally with the condition of the gas business in the Metropolis of America, which is not only of interest, but also not without its moral.

Before looking at the state of affairs to-day, it may be well to go back a little and take a slight glance at the early history of the various Companies; and I shall confine myself to the city proper. The first "grant" by the City of New York to a Gas Company was that to the New York Gaslight Company, dated May 12, 1823, being for the portion of the city south of Grand Street; and at the time this limit included most of the thickly-settled portion of the city. About ten years later—May 8, 1833—a "grant" was given to the Manhattan Gas Company to lay pipes from Grand Street up to Sixth Street; but this portion of the city becoming rapidly built up, the limit of the Company was, in 1847, extended to Forty-second Street, and later the boundary was carried up till it reached Seventy-ninth Street.

In 1858 the city made what I feel was a mistake, in giving a grant to the Metropolitan Company to lay pipes in any portion of the city, and thus enter into competition with both Companies. They, however, confined themselves to the portion of the city between Thirty-fourth and Seventy-ninth Streets, being pitted against the Manhattan Company; but an arrangement was before long arrived at, whereby the Manhattan Company supplied gas only below Thirty-fourth Street. So things ran smoothly till 1872, when the Mutual Company, with power to go over the whole city, began to make gas. This unsettled things, because not only were private customers changing from Company to Company, but the old Companies could not tell how soon the contract to light the public lamps might pass from them. The Mutual Company claimed to be able to make gas much cheaper than the old Companies, but as they used naphtha in a great measure to make their gas from, the older Companies rather had the best of it, and undoubtedly an arrangement could have been arrived at, if another competitor—the Municipal Company—had not stepped in to render things more complicated. Making their gas by a modification of the Tessié du Motay process, they supply a brilliant white light; but whether the large proportion of CO this gas is said to contain is a serious objection to its use, is another question. It is, however, undoubtedly true that they have taken away a good deal of business from the other Companies, trying apparently to get the tender loin, laying the pipes chiefly where the large consumers exist.

From last summer up to within a few weeks, a competition of the most disastrous character was indulged in by these various Companies. It was led off by the Manhattan Company reducing the price, and the other Companies quickly fell in like, till the price was reduced from 2 dols. 25 cents to from 1 dol. 50 cents to 75 cents; and with a little "shopping around" the larger consumers could get extra inducements thrown in, even at the lower figure. Then, indeed, was there rejoicing in the ranks of the gas consumers, truly did they think that the days of cheap gas had come, and their joy was only equalled by their indignation now that the price has gone back to the old point. As if the Companies would continue for ever to supply gas at less than it cost to make it! It is not found that the opposition Companies entered the field out of love for mankind, but to make money; and if for a time the price of gas reached an unnaturally low figure, it will now quickly regain its old point, for one of two things must have happened—either the weaker would have to sell out to the stronger, or else a "mutual arrangement" would be arrived at. In the present instance the fight was ended by a mutual arrangement (the terms of which are kept dark); and a general shaking of hands and raising of the prices ensued. At the latter move the consumers are very indignant, and the customers of one Company are trying to force them back to the low price. They have formed a permanent association, called the Municipal Gas Consumers Protection Association, and seem determined to do all in their power to obtain cheaper gas. It remains to be seen what success they will meet with. A Committee have been appointed to wait on the Company to present what they call their grievance. This protest is worthy of notice, because if they cannot secure their end in any other way they may invite the consumers of the other Companies to join them and petition the Legislature, and any action taken by that body in the present state of public opinion would probably be unjust towards the Companies. In the meantime, the course the Companies should pursue is evident—amalgamate, reduce the capital account, and endeavour to effect an agreement with the Authorities, whereby a price which would be fair to all parties would be charged, in consideration of the exclusion of all competition. There has been nothing to induce the Companies to do anything but charge as high a price as they dared, when they knew how likely it was that competition would ensue.

On the afternoon of April 14 a serious explosion of gas occurred at the works of the New York Company, fatally injuring three of the workmen. The explosion occurred in the scrubber-house, and it appears that the manhole plates had just been removed from one of the scrubbers, preparatory to the execution of some repairs, when the explosion occurred. At the time the daily papers gave it as the opinion of the officers of the Company that the rays of the sun might have been brought to a focus, in passing through the window, on a piece of waste, setting it on fire, and thus causing the explosion. To say the least, this seems very improbable. Now the opinion is advanced that a spark from one of the engines of the elevated railroad caused the disaster, which also hardly seems probable, as sparks of any size dropped by these engines come direct from the furnace, and land in the road; and a spark to have to reach these gas-works must have been ejected from the smoke stack, where there is a fine screen to prevent such an occurrence. Any spark that could escape from the smoke stack would be of so small a size that it would not have heat enough to cause the explosion by the time it reached the scrubber-house. I have known a piece of waste, when left on a pipe or other metal surface heated by steam, to smoulder to such an extent that it would have to be removed with caution to prevent its breaking into a flame; and perhaps herein may lie the cause of this accident.

I had intended to touch upon some other matters, but the length this communication has already reached forces me to defer doing so to another time.

THE LANCASHIRE COAL AND IRON TRADES.

(FROM OUR OWN CORRESPONDENT.)

There is practically little or nothing to report this week, so far as business is concerned, in either the coal or iron trades of this district. Since Wednesday most of the collieries and iron works have been closed for the holidays, and business has been altogether suspended. Nominally prices are the same as the previous week, and for gas-making coals I hear of low figures being quoted. The average prices at the pit mouth may be given about as under:—Best coal, such as good screened Wigan Arley, 7s. 6d. to 8s.; seconds, such as inferior Arley and Pemberton four-feet, 6s. to 6s. 9d.; common round coal, 5s. to 5s. 6d.; burgy about 4s. to 4s. 3d.; and good slack, 3s. 6d. to 3s. 9d. per ton. In iron, local smelters are still asking about 52s. 6d. per ton, less 2½, for foundry and forge, delivered into the Manchester district. Bars could be bought at £6 12s. 6d. to £7, and puddled bars at under £4 per ton, but there is nothing doing.

An important development of the coal resources of the Manchester district is being effected at Ashton Moss, where, after operations extending over the last five years, valuable seams of coal varying in thickness from 2 ft. 6 in. to 4 ft. 6 in. have been proved, the existence of which, at least at a workable depth, had previously been regarded with very considerable doubt.

THE SOUTH STAFFORDSHIRE COAL AND IRON TRADES.

(FROM OUR OWN CORRESPONDENT.)

As usual at holiday time, but little has been done at the collieries in this district during the past week; nor is there much hope that business will be very brisk for the next few weeks to come. Matters at the present time are not so satisfactory as the promise of a month ago had led masters to look forward to, and a downward movement in the iron market will lead, it is feared, to a reduction in the price of fuel. At most of the South Staffordshire mines the output is not so great as it was during the early part of the year. Underselling is going on, and complaints of this practice are daily being made. Its continuance, aided by a weak and sluggish market, will doubtless hasten a downward tendency to a general alteration of tariff. Notice of a reduction of wages to the amount of 3d. per day was given by several of the large colliery owners hereabouts, and this came into effect on Saturday. The miners are crying out against the reduction, and on Thursday last a meeting of the men employed at Pelsall Hall Colliery, the Pelsall Coal and Iron Company's pits, and some half dozen others in the district, was held, to protest against any further reduction of wages. There is plenty of ironmaking coal for immediate use in stock, and but little has been imported into the district of late. In gas coals there is a fair business being done, and prices are more even in this branch. At the Cannock Chase and Brownhills Collieries things have shown no material alteration, and the demand for house coals is fairly good. In the Cannock Chase district, however, there is a feeling of dissatisfaction existing at the present arrangement of the sliding scale, and the union men are making efforts to get an early alteration of the same effected.

Coke is not in good request, but prices are quoted at the rates given last week.

The iron trade remains unaltered, though a few additional furnaces have been blown out. The production, when compared with that of a month ago, shows but little diminution, and it is now stated that many more furnaces were relit than were really needed to supply the wants of the market. Nevertheless, stocks have again accumulated, and a general reduction must follow. The Earl of Dudley and Messrs. Barrows, of the Bloomfield furnaces, have issued circulars to their customers, notifying a reduction of £1 per ton on marked bars. Other makers, it is stated, will shortly follow these examples. The Earl of Dudley's Manager, who is also the inventor of the Casson-Dormoy furnace, started a few days ago on a tour of inspection to the principal iron-works in the United States. The business being done with the American market is not of that cheerful character which makers looked forward to at the commencement of the quarter, and this fact is owing, to a great extent, to the altered tone of affairs. India continues to be the good market for all kinds of foundry iron-work, which is perhaps the most hopeful feature of the trade. The markets at both Wolverhampton, on Wednesday, and Birmingham, on Thursday, were unusually dull and quiet. Sales were slow, and there was underselling in branded bars and sheets. Pig iron was not in good request, but foundry iron was more actively inquired after. Nail rods, hoops, and common sheets were offered at prices much the same as quoted a week ago. For galvanizing sheets, also for iron and tube making, and for boiler plates, there was an average inquiry.

THE YORKSHIRE COAL AND IRON TRADES.

(FROM OUR OWN CORRESPONDENT.)

The collieries, with few exceptions, were closed for several days last week on account of the Whitsuntide holidays, and operations in many were not resumed until Thursday, owing to the quiet, and almost unprecedented state of trade. As was stated in my last report, several important contracts for gas coal were pending, and were exciting a good deal of interest amongst colliery proprietors. The Nottingham gas coal contract for 100,000 tons per annum has been decided, and it is believed has been placed on as advantageous terms as before. It is stated that part of the contract has been given to the Thorncliffe Collieries, where a capital

gas coal is raised; but, with this exception, no part of the contract seems to have been placed in Yorkshire. There is but little improvement to be noted with respect to the demand for either the Silkstone or Barnsley thick-seam coal for London and the South, on which many collieries have to rely for trade. There is also but a limited business doing in household qualities for the Eastern Counties and Lincolnshire, whilst home sales are very moderate.

The production of locomotive and steam coal is pretty large, considering the resources of the district collieries. There is more doing in connection with the export trade to the Baltic and other ports. The South Yorkshire pits have the advantage of the coalowners in the West Riding with respect to the Grimsby trade, but the latter body enjoy greater facilities and an easier rate from Normanton and the West Riding district to Hull. Efforts are, however, being made to extend the Hull trade in South Yorkshire, and at the Oaks and some other pits where steam coal is largely raised a goodly number of the waggons are being fitted with "hopper" bottoms, in order to more easily facilitate the shipment of the coal into the vessels and steamers. Coalowners are earnestly waiting the decisions come to with regard to the supplies of locomotive and other kinds of fuel required by the Midland and Great Eastern Railway Companies, whose contracts are now being placed.

No change can be noted with respect to the coke trade, which of late has formed an important branch of mining operations. The output throughout Yorkshire, but particularly in the southern part of the coal-field, is very large, and is being almost constantly increased by the erection of some new ovens, tenders for completing 28 new ones at the North Gawber Hall Colliery being asked for at once. The demand for North Lincolnshire holds up well, notwithstanding the competition of Durham and North of England makers.

The chief feature of the week has been the visit of the Royal Commission on Accidents in Mines, who came to the South Yorkshire district on Thursday. The main object was a personal inspection of several of the collieries where sudden and destructive outbursts of gas have from time to time taken place, extinguishing the miners lamps, and in some instances firing them. The whole of the Committee, except Lord Lindsay and Sir G. Elliott, were present, and visited the Strafford Collieries and the Oaks Collieries—the former working the Silkstone, and the latter the Barnsley seam of coal—at both of which places several alarming outbursts have occurred.

The iron trade has undergone but little change during the past week. The output of pig iron has been maintained, but there has been little work done at the foundries and some of the forges, on account of the holidays.

THE COAL AND GENERAL TRADES OF THE NORTH OF ENGLAND.

(FROM OUR OWN CORRESPONDENT.)

The shipment of coals from the Tyne improved last week. They were equal to 6000 chaldrons a day from the Tyne Dock alone. The demand for gas coals is a moderate average. Best qualities ruled about 7s. a ton f.o.b. on the Tyne; 6s. 6d. medium qualities; 6s. per ton and less money for inferior sorts. Coke is not so dull as it was, sales having become better over the past week or ten days. Steam coals are in good demand. The better sorts of small coals sell well for local consumption. Stronger prices are paid. There have been improved arrivals of coasting vessels, which have come to load gas coals in the Tyne. They were engaged before they left their port and arrived here, as a rule. Very few seeking vessels have therefore been taken up. A few foreign sailing ships have been offered to load coals to carry coastwise at comparative low rates. Channel freights for sailing vessels are about 6s. per ton, and to the North of France 6s. 6d. to 6s. 9d. per ton. There is a pretty good supply of steamers for the home trade; but handy boats are rather scarce for long voyages. Higher freights have, therefore, had to be paid for steamers to load coals oversea.

Fire-bricks and fire-clay goods continue to be supplied to the northern ports of Europe, and the trade is well maintained; but chemicals seem to have entirely collapsed for the time. Prices of some articles have been as low as in the worst times. There are few speculative transactions, and but a limited number of orders. The outlook in the trade can only be described as unsatisfactory.

Foundry work is getting slack in the Tyne. Few gas or water pipes are shipped abroad at present. The iron trade is generally dull and irregular. Lead is cheaper. English makers, however, refuse to sell at present prices. Copper is slightly better. The importation of timber into the northern ports is not excessive. The consumptive demand has improved. The prices are stiffer; but there is no great advance.

TRADE NOTES FROM SCOTLAND.

(FROM OUR OWN CORRESPONDENT.)

The annual general meeting of the Stonehaven Gas Company was held last week—Mr. Alexander Weir, Bath Lodge, Chairman of the Company, presiding. The balance-sheet and statement of the affairs of the Company, for the year ending April 30, were submitted to the meeting, and were considered very satisfactory, the profit for the past year amounting to £569 6s. 9d. On the recommendation of the Directors, a dividend of 8½ per cent. was declared, being 6d. per share more than the dividend declared a year ago. The following gentlemen were appointed to the directorate for the ensuing year—namely, Provost Wood, Messrs. Thomas Mitchell, Alexander Weir, George Strathelee, David Carr, A. W. Kinnear, D. B. Hutcheon, J. W. Thomson, and J. G. Soutar. At a meeting of the Directors, held after the general meeting, Mr. Alexander Weir was re-elected Chairman of the Company, with Mr. James Wood as Secretary and Treasurer, and Mr. James Ross as Collector; and it was resolved to reduce the price of gas 5d. per 1000 cubic feet—from 5s. 5d. to 5s.—and to reduce the meter-rents from 2s. to 1s. 6d. per annum. The street-lamps of Stonehaven are wholly kept up by the Gas Company free of charge, so that if that circumstance were taken into account, and the Company were paid for the lamps, the price to ordinary consumers would now stand at 4s. 9d. per 1000 feet.

A man named William Smith, a bricklayer, residing in Allison Street, Ayr, was cited to appear before Bailie Sloan, at the Ayr Burgh Court, on Monday, the 17th inst., charged with tampering with the gas-meter in his house. He failed to appear, and forfeited his bail of £3.

The monthly meeting of the Forfar Corporation Gas Commissioners was held on Monday last week—Provost Lowson presiding. The question of borrowing powers was again up for consideration. Following the advice of the Parliamentary Agent, the Gas Committee recommended that additional powers should be applied for, by means of a Provisional Order under the Police Act. In supporting the recommendation, Bailie Laird, the Convener, made a long statement regarding the affairs of the Gas Commission, and the Provost and other speakers followed. In the course of the discussion it was generally agreed that the financial affairs of the Commission had been mismanaged, because the money standing at the credit of the contingent and sinking funds had been applied to the extension of the gas-works, and that after all the bank account was overdrawn, and the borrowing powers exceeded by £3000. The gas had also been sold at too low a price. It was agreed to adopt the recommendations of the Committee, and it was remitted to a Committee to report on the amount required.

Some few weeks ago it was announced that a difficulty had arisen between the Gas Company and the Police Commissioners of Musselburgh in regard to the amount of the claim made for the price of gas by the first-named body. It has now transpired that the amount offered by the Commissioners—£82 19s.—has been accepted by the Gas Company. In referring to the matter at the last meeting of the Police Commissioners, Bailie Riddock stated that there would probably be no further disputes regarding the quality of the gas.

While in London lately, in connection with a parliamentary Bill, several of the Clyde Lighthouses Trustees visited the works of Pintsch's Gas Company, where the gas is manufactured for the buoy lighted on the Shoals Patch, Roseneath Point. It is stated that the Trustees are so satisfied with the result of the experiments at the Shoals Buoy that they intend shortly to extend the system, and that in a few weeks the buoy at Skelmorlie will be replaced by one similar to that at Roseneath, while before the winter arrives the buoys between Greenock and Glasgow will also be provided with the same illuminating power. At present the gas has to be brought in tanks from Pintsch's works in London, but when the new arrangements are entered into a small works will be erected on the banks of the Clyde for the manufacture of the gas.

Business was done in the stock of the Edinburgh Gas Company last Tuesday at £45 15s., being an advance of 5s. upon that of the previous Saturday.

Messrs. J. and A. Leslie, Civil Engineers, Edinburgh, have lately reported that with favourable weather the Dunfermline Water-Works will be completed by the end of August, the embanking of the reservoir having now been raised to within 42 feet of the top in the lowest part of the valley.

At the last monthly meeting of the Edinburgh and District Water Trustees, the following motion was agreed to by a large majority, namely —"That the sum in the new Bill be increased to £150,000, with the view of paying the cost of new mains and extension of pipes for a period of years out of capital; and that the Trustees remit to the Bill Committee to endeavour to have that sum inserted in the Bill." It was also agreed that consumers of water beyond the compulsory area embraced by the Water Acts should be charged 6 per cent. on the cost of laying down pipes, and 2d. per £1 on their rental, in excess of the cost of the domestic water-rate for Edinburgh; and it was further resolved that persons using water in bulk should pay 2d. per 1000 gals., and 6 per cent. on the cost of laying down the necessary pipes.

Mr. J. F. Bateman, C.E., lately visited Perth in connection with the new water-works, and attended a special meeting of the Water Commissioners, by whom he was subjected to a course of questioning on the effect on the health of the inhabitants, of the alleged poisoning of the water supply. He said it was almost impossible to get all the joints of the new pipes absolutely perfect at first, but he believed the admixture of sewage with the water supply was so slight as to be positively harmless to the public health, and he had given instructions to have the weakest part of the pipes embedded in concrete. On being further interrogated, Mr. Bateman said he believed the water collected in the filters which were supposed to have been contaminated was as pure as any to be obtained anywhere in the country. There was no better water in existence than that with which Perth was supplied. As to the effect of impurities on the public health, that was a matter for a chemist, and not an engineer; but speaking as an engineer and not as a chemist, he did not believe there were any grounds whatever to fear pollution. On the motion of Lord Provost Richardson, Mr. Bateman was thanked for his explanations. The extended water supply scheme for Perth is capable of providing a population of 30,000 inhabitants with 900,000 gallons per day. Since Mr. Bateman's interview with the Commissioners, the medical men of Perth have held a meeting for the purpose of considering the present unhealthiness of the city. There were ten doctors present, and after some discussion they passed the following resolution:—"That, in the opinion of the undersigned medical men in Perth, the present excessive sickness and death-rate in the city are due to pollution of the water supply, possibly aggravated by atmospheric influences and defective drainage; and that until the well and pipes are absolutely water-tight, and the general sewage carried beyond the filter-bed, matters cannot be permanently rectified." A Committee was appointed to confer with the Local Authority on the subject.

The Town Council of Hawick, at a meeting held last Thursday, resolved to introduce an additional supply of water from Dodburn, about six miles distant from the town. The new scheme provides for a supply of 600,000 gallons per day, at an estimated cost of £15,592, or about 4d. per pound on the rental. This, with the present supply, will raise the total to about a million gallons for 15,000 people.

It is reported that the new water supply scheme from the Dhu Loch, for meeting the wants of the inhabitants of the higher parts of Rothesay, is giving the most thorough satisfaction.

The Shareholders of the Forres Water Company, at their annual meeting recently held, declared a dividend of 5 per cent., as against 6 per cent. last year. Forres is one of the very few Scotch towns where the water supply is still in the hands of a private Company.

Last week's Glasgow pig iron market was dull, and only a limited amount of business was done at gradually receding prices. The highest price was 46s. 4½d. cash on Monday, and as low as 45s. 6d. cash was accepted on Friday afternoon. Manufactured iron is excessively quiet, and manufacturers are usually willing to meet the demands of buyers for lower prices.

No improvement is yet showing itself in the coal trade.

WELLS (SOMERSET) GAS COMPANY.—The annual general meeting of this Company was held last Tuesday, when the notice convening the meeting having been read by the Secretary (Mr. Edward Padfield), the Chairman announced that the Directors had resolved that full dividends should be paid on all classes of shares, and, in addition, 2 per cent. upon all stock except the preference shares. Other matters were then dealt with, and in the end a hearty vote of thanks was given to the Chairman.

THE HOLYWELL GAS ORDER OF THE BRITISH COMPANY.—At a special meeting of the Holywell Local Board last Wednesday, it was unanimously agreed to oppose the confirmation of the Provisional Order granted by the Board of Trade for further powers to the British Gaslight Company in respect to their Holywell undertaking. A public meeting of the owners and ratepayers of the town will now have to be held, to sanction this resolution, if the costs of the opposition are to be paid out of the borough rates.

LIVERPOOL GAS FITTINGS COMPANY, LIMITED.—The fourth annual meeting of this Company was held last Tuesday—Mr. S. H. Thompson in the chair—when the Directors report on the operations for the twelve months ending March 31 was presented. It congratulated the Shareholders on the satisfactory result of the year's work, the net profit for that period being £1418 2s. 4d., which, with £693 14s. 2d., the balance brought from the previous year, left the sum of £2111 16s. 6d. to the credit of profit and loss.

The Directors recommended that a dividend be declared for the year at the rate of 10 per cent., with a bonus of 1s. per share (free of income-tax), which would leave £611 16s. 6d. to be carried forward to next year's account. The Chairman moved, and Sir Thomas Earle seconded, the adoption of the report, which was agreed to; as was also the dividend recommended in it. On the motion of Mr. J. Darcie, seconded by Mr. J. F. Robinson, a vote of thanks was accorded to the Chairman and Directors for the satisfactory way in which they conducted the affairs of the Company; and a similar compliment was paid to the Secretary and Manager (Mr. Samuel Haynes) and the Officers, for their services.

Death of Mr. J. Barclay, of Brechin.—We regret to announce the sudden death of Mr. James Barclay, the highly-respected Manager to the Brechin Gaslight Company, and one of the oldest gas managers in Scotland, if not, indeed, the very oldest. Mr. Barclay, who was in his seventy-sixth year, died last Wednesday morning. Our correspondent writes: "Appointed Manager to the Gas Company so long ago as the year 1842, he continued to discharge the duties of his office single-handed until about eight years ago, when the increasing business of the Company rendered necessary the appointment of a Collector in addition to the Manager. Advancing years led Mr. Barclay during last winter to resign the management, and arrangements had been completed by the Directors to relieve him at this term, and he was to have left the Company's house in a day or two in order to make room for his successor. Mr. Barclay was, however, fated to breathe his last on the premises of the Company whom he had served so long and so well during the whole period of his management. It is no exaggeration to say that the deceased had the prosperity and welfare of the Company continually in his mind both by night and by day."

Register of Patents.

APPLICATIONS FOR LETTERS PATENT.

1980.—Wischen, G., Prague, Austria, "Improvements in and appertaining to the distillation of anthracene from coal tar." May 14, 1880.

2001.—Urquhart, J., Manchester, "Improvements in meters or apparatus employed in measuring the flow of fluids." May 15, 1880.

2018.—Lake, W. R., Southampton Buildings, London, "Improvements in the manufacture of gas, and in apparatus therefor." A communication. May 18, 1880.

2039.—Howorth, J., Farnworth, Lancs, "Improvements in and connected with ventilators or apparatus for exhausting, forcing, or compressing air, gases, or other products." May 19, 1880.

PATENTS WHICH HAVE PASSED THE GREAT SEAL.

4712.—Franks, M., Blaenavon, South Wales, "An improved reflector or distributor of light for lamps or other similar lighting apparatus." Nov. 19, 1879.

4820.—Edmonds, E., Fleet Street, London, "A new or improved gas motor or engine, and new arrangements of mechanism employed with the same." A communication. Nov. 25, 1879.

4917.—Dehaynin, F. G. C., Paris, "Improvements in apparatus for the simultaneous production of steam, hydrogen, and oxyde of carbon, in order to produce a gas proper for supplying gas-movers, singeing fabrics, heating apartments, and other similar applications." Dec. 1, 1879.

PATENTS WHICH HAVE BECOME VOID

BY REASON OF THE NON-PAYMENT OF THE ADDITIONAL STAMP DUTY OF £50 BEFORE THE EXPIRATION OF THE THIRD YEAR.

1805.—Dülken, A., "A new mode of constructing water-meters, capable of serving at the same time as prime movers." May 9, 1877.

1822.—Milne, J., "Improved appliances to railway and tramway carriage gasholders, whereby they may be automatically charged." May 10, 1877.

PATENTS WHICH HAVE BECOME VOID

BY REASON OF THE NON-PAYMENT OF THE ADDITIONAL STAMP DUTY OF £100 BEFORE THE EXPIRATION OF THE SEVENTH YEAR.

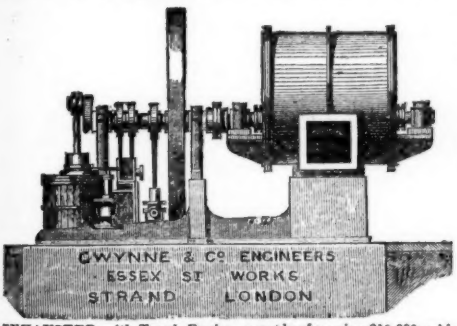
1285.—Ellis, A. W., "Improvements in the utilization of waste products of ammoniacal liquor." April 8, 1873.

1287.—Rowland, T. F., "Improvements in apparatus for supplying and measuring coal and charging and emptying gas-retorts." April 8, 1873.

1533.—Colls, F. W., "Improvements in the manufacture of gas for heating and lighting purposes, and in the apparatus employed therefor." April 28, 1873.

The GRAND MEDAL of MERIT at the VIENNA EXHIBITION, TWO MEDALS at the PHILADELPHIA EXHIBITION and TWO MEDALS at the PARIS EXHIBITION, have been AWARDED to GWYNNE & CO. for GAS-EXHAUSTERS, ENGINES, and PUMPS; Also 27 OTHER MEDALS AWARDED at all the GREAT INTERNATIONAL EXHIBITIONS.

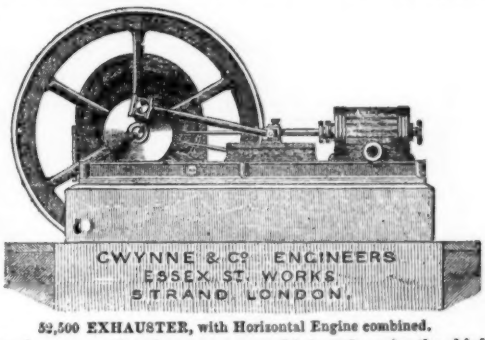
GWYNNE & BEALE'S PATENT GAS-EXHAUSTERS & ENGINES.



EXHAUSTER with Trunk Engine, capable of passing 210,000 cubic feet per hour.

The Judges report on the combined Exhauster and Steam-Engine exhibited at the Philadelphia Exhibition is—"*Reliable compact Machine, well adapted for the purpose intended, of excellent workmanship.*"

GWYNNE & CO. have made the largest and most perfect Gas-Exhausting Machinery in the world, and have completed Exhausters to the extent of 8,000,000 cubic feet passed per hour, of all sizes from 2000 to 210,000 cubic feet per hour.



52,500 EXHAUSTER, with Horizontal Engine combined.

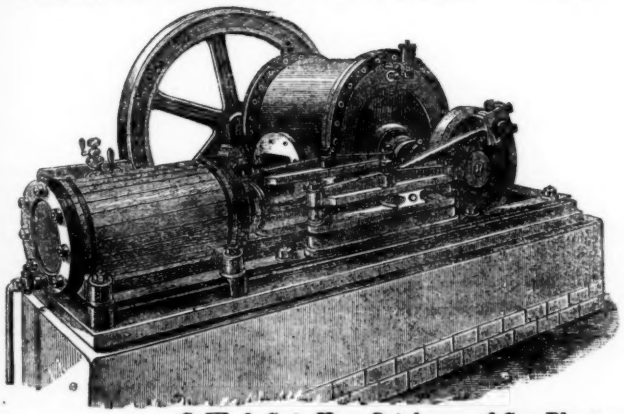
GWYNNE & CO. do not pretend to enter into a struggle with other makers in respect to cheapness. They have never sought to make price the chief consideration, *but to produce machinery of the very highest quality, and most approved design and workmanship.* The result is that in every instance their work is giving the fullest satisfaction. Numerous testimonials and references can be given to Companies using their Machinery for years past.

Exhausters, with or without Engines combined, can be made to pass the gas WITHOUT OSCILLATION OR VARIATION IN PRESSURE Regulators, Bye-Passes, Stop-Valves, Gas-Valves, Station Governors, and Gas Machinery of all Sizes.

PLEASE ADDRESS IN FULL, GWYNNE & CO., Hydraulic and Gas Engineers, ESSEX STREET WORKS, VICTORIA EMBANKMENT, LONDON, W.C., ENGLAND.

Gwynne & Co.'s New Catalogue on Gas-Exhausting and other Machinery may be obtained on application at the above Address.

BEALE'S IMPROVED PATENT GAS EXHAUSTERS,



WITH

Wrought-Iron Spindles and

ENGINES COMBINED.

SOLE MAKERS,

GEORGE WALLER & CO.

MAKERS OF ENGINES, EXHAUSTERS, INDEX AND DISC GAS-VALVES, HYDRAULIC MAIN VALVES, BYE-PASS VALVES, TAR, LIQUOR, AND OTHER PUMPS, SCRUBBERS AND PURIFIERS, CONDENSERS, BOILERS, &c.

G. W. & Co.'s New Catalogue of Gas Plant and Machinery can be had on application.

[*SEE ALSO ADVERTISEMENT, PAGE* 814.]

Phœnix Engineering Works:

HOLLAND STREET, SOUTHWARK, S.E.

WANTED, Readers of the NEW Edition, "Cooking & Heating by Gas;" on Burners, &c. Copies, by post, Threepence, direct from the Author, MAGNUS OHREN, Assoc.M.I.C.E., Gas-Works, SYDENHAM.

TO GAS COMPANIES AND OWNERS OF GAS-WORKS.

THE Advertiser offers his Services as MANAGER or Manager and Secretary of small, or Assistant in large Works. Having had several years experience (two years as Manager of a Works making 20 millions), is well acquainted with every detail of Manufacture, Office Work, &c. Unexceptionable references as to character and ability.

Address No. 656, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

TODMORDEN GAS COMPANY.

WANTED, an Energetic Man as Col-lector and Meter Inspector. Salary £65 per annum. Security required.

Address, on or before the 27th inst., in own handwriting, stating age, qualifications, &c., to

HENRY A. COLES, Manager.

Gas-Works, Todmorden, May 14, 1880.

WANTED, a Working Manager for the Wigston Gas-Works, near Leicester. Eight retorts in use last winter. Will be required (with assistance in winter) to do all Stoking, Main and Service Laying, Meter Fixing, &c. House, coal, and gas provided.

Applicants to enclose testimonials, and state age, where and when last employed, and wages required.

JAMES SHARP, Secretary.

Wigston Magna, May 22, 1880.

THE Corporation of Birkenhead are prepared to receive APPLICATIONS for the Office of ENGINEER, to Take Charge of the Gas-Works in that town. The candidate appointed would be required to devote the whole of his time to the duties of such office.

He must be thoroughly experienced in the manufacture and distribution of Gas, and must be competent to design and carry out additions to and extensions of Gas-Works.

The quantity of Gas at present made in the Birkenhead Gas-Works is about 250 million cubic feet per annum.

Applications, stating age, qualifications, and salary required, not exceeding £300 per annum, together with testimonials, addressed to the Chairman of the Gas and Water Committee, Municipal Offices, Birkenhead, and endorsed "Gas Engineer," must be sent in on or before Monday, the 7th day of June prox.

By order,

AMBROSE WALN, Town Clerk.

Municipal Offices, Birkenhead, May 22, 1880.

WANTED, a good Second-hand EXHAUSTER, about 2000 ft. per hour.

State price and condition to D. J., 3, Queen's Terrace, MIDDLESBROUGH-ON-TEES.

TO ENGINEERS AND MANAGERS OF GAS-WORKS.

WANTED, good Second-hand Gas PLANT, viz.:—

One Purifier, 9 ft. by 7 ft., Wood Sieves, &c., complete, with 6-in. Inlet and Outlet; 500 yards of 3-in. Socket and Spigot Pipes, in 9 ft. lengths.

Retort Mouthpieces, 15-in. Circular, Cross-Bars and Lids, Ascension-Pipes, Saddle-Pipes, and Dip-Pipes.

Apply to Mr. BENJAMIN FARMER, Secretary to the Gas Company, Shifnal, SALOP.

SLEAFORD GAS COMPANY, LIMITED.

FOR SALE—Single Gasholder, 32 ft. by 14 ft., Counter-balanced, Connections and all complete, in good condition. Reason for removal, ground wanted.

Particulars to be had of HARRY WINHURST, Manager.

FOR SALE—A Second-hand Square STATION-METER, to pass 40,000 cubic feet per hour. Erected about 12 years. Made by Messrs. J. and J. Braddock, Oldham. Now in use at the Plymouth Gas-Works. To be removed to make place for a larger sized Meter. To be sold a bargain.

For price and particulars apply to W. W. ANDREWS, 238, Kingsland Road, LONDON.

A BARGAIN.

FOR IMMEDIATE SALE—A Round STATION-METER, capable of passing 2500 cubic feet per hour (clock in centre), three 4-in. Bends, and one 5-in. Four-way Valve, which have been taken down to make room for a larger one.

Apply to Mr. W. C. DAWSON, Gas-Works, ARUNDEL.

EXHAUSTER FOR SALE.

THE Malton Gas Company have for Disposal an EXHAUSTER and ENGINE, erected by Messrs. Dempster in 1873, capable of passing 7000 cubic feet per hour.

It may be seen in operation, and further particulars obtained on application to the undersigned.

HENRY TOBEY, Secretary.

FOR IMMEDIATE SALE.

SIX MOUTHPIECES, with Morton's Lids, for 21 in. by 15 in. Oval Retorts, Ascension, Arch Dip-Pipes, and Wrought-Iron Hydraulic Main.

Combined Engine and Exhauster, to pass 5000 ft. per hour.

10-ft. Square Purifier, with Wrought-iron Cover and Lifting Gear.

Gasholder to contain 7000 feet.

Station-Meter to pass 3000 ft. per hour.

One Wrought and One Cast Iron Coffey's Still or Washer

Exhauster Governor, Throttle and Bye-Pass Valves.

Steam, "Special," and Force Pumps; Rope Hoist.

Small quantity of 6-in. Cast-Iron Pipe and Connections, and 4-in. Hot-Water Pipe, and Sundries.

Apply to C. E. BOTLEY, Gas-Works, Wormwood Scrubbs, KENSAL TOWN, W.; or to the SECRETARY of the New Gas Company, Limited, 16, George Street, MANSION HOUSE, E.C.

CAMBRIDGE UNIVERSITY AND TOWN GASLIGHT COMPANY.

TO MANUFACTURING CHEMISTS AND OTHERS.

THE Directors of the above-named Com-pany have for Sale about 190 tons of Spent OXIDE OF IRON.

The same may be seen and samples taken upon application to

JAMES WEEKS, Manager.

Gas-Works, Cambridge, May 21, 1880.

CAMBRIDGE UNIVERSITY AND TOWN GASLIGHT COMPANY.

THE Directors of this Company have for Sale the undermentioned PLANT:—

18 Lengths of Hydraulic Main, each 9 ft. long, 18 in. by 15 in. diameter.

Three Lengths of Hydraulic Main, each 10 ft. long, 19 in. by 17 in. diameter.

126 Mouthpieces, with Ascension-Pipes, complete.

One Condenser, formed of 52 9-in. Pipes.

One Scrubber, 20 ft. high, 5 ft. diameter.

One Purifier, 11 ft. 6 in. square.

One ,, 14 ft. ,,

One Travelling Crane for the above.

One Meter to pass 15,000 cubic feet per hour.

One Governor to pass 30,000 ,, ,,

Two 9-in. and eight 12-in. Valves.

Four Wrought Girders, each 44 ft. long by 17 in. by 6½ in.

Two Cast Columns, each 21 ft. long by 13 in. by 10 in.

Two ,, ,, 14 ,, 10 ,, 8 ,,

Two ,, ,, 11 ,, 9 ,, 7 ,,

One ,, ,, 10 ,, 12 ,, 10 ,,

The above may be seen and further particulars obtained of

JAMES WEEKS, Manager.

Gas-Works, Cambridge, May 21, 1880.

GAS PLANT FOR SALE.

THE Coventry Gas Company have for SALE—

SCRUBBERS.—One 5 ft. 6 in. diameter, 15 ft. high. One 5 ft. diameter, 20 ft. high; with or without 8-in. Connections and Valves.

STEAM-JET VENTILATOR.—One No. 2 Körting's Patent Jet Ventilator, with Cheat. One No. 3½ Körting's Patent Jet Blower.

VALVE.—One 12-in. Cathels's Four-way Valve.

The above are being replaced by larger apparatus, and can be removed at once. Also a 100-light Gas Apparatus (Porter's make); this includes a Gasholder, 14 ft. diameter and 10 ft. high, which could be sold separately.

For particulars and prices apply to

W. L. ROBINSON, Manager.

Gas-Works, Coventry, April 17, 1880.

THE Sheffield United Gaslight Company OFFER for SALE the following lots of Retort-House FITTINGS, which they are now taking down at two of their Stations:—

54 Pieces Cast-Iron Hydraulic Main, U-shaped, 9 ft. 6 in. by 18 in. by 18 in.

16 Pieces Cast-Iron Hydraulic Main, U-shaped, 9 ft. 6 in. by 18 in. by 15 in.

4 Pieces Cast-Iron Hydraulic Main, U-shaped, 9 ft. 6 in. by 16 in. by 15 in.

320 Cast-Iron Mouthpieces, D-shaped, 21 in. by 15 in.

160 Lengths 4 in. Cast-Iron Ascension-Pipes, straight, 7 ft. 6 in. long.

215 Lengths 4-in. Cast-Iron Ascension-Pipes, straight, 5 ft. 6 in. long.

50 Lengths 4-in. Cast-Iron Ascension-Pipes, curved, 5 ft. 6 in. long.

60 Lengths 4-in. Cast-Iron Ascension-Pipes, curved, 2 ft. 8 in.

37 Lengths 4-in. Cast-Iron Ascension-Pipes, curved, 10 ft. 2 in.

40 Lengths 4-in. Cast-Iron Ascension-Pipes, straight, 5 ft. 10 in.

17 Lengths 4-in. Cast-Iron Ascension-Pipes, straight, 5 ft. 5 in.

481 Lengths 4-in. Cast-Iron H-Pipes.

506 Lengths 4-in. Cast-Iron Dip-Pipes.

The above apparatus has been in use up to a recent date, and is adapted for re-erection.

The Company will be prepared to receive an offer for the whole or any portion of the above. Price £4 per ton, loaded into trucks at Sheffield.

Applications to be addressed to the undersigned.

THOS. ROBERTS, Manager.

Gas Office, Sheffield, March 25, 1880.

THE Gloucester Gas Company, ceasing to manufacture gas at their old works, will have the undermentioned APPARATUS for Sale about the beginning of August, viz.:—

About 150 feet of D-shape Wrought-Iron Hydraulic Main, size 19 in. by 19 in. Also about 38 ft. of D-shaped Wrought-Iron Hydraulic Main, size 20 in. by 20 in. Annular Condenser, consisting of six Vertical Pipes, 24 in. diameter, 19 ft. high, with three 12-in. Slide-Valves and 12-in. Connections.

Scrubber (round), 5 ft. by 20 ft., with three 12-in. Slide-Valves, and 12-in. Connections.

Exhauster (Jones) to pass about 15,000 feet per hour.

Exhauster (Beales) to pass about 25,000 feet per hour.

Two Vertical Steam-Engines, each about 6-horse power, with Pulleys, and Shafting used for driving the above.

Boiler 14 ft. 6 in. by 3 ft. 6 in., with Centre Tube, and four Galloway Patent Tubes.

4-horse power Horizontal Steam-Engine.

Three 4-in. Pumps, with cranked Shafting and a pair of Mitre Wheels.

Two Purifiers, 16 ft. by 8 ft., with six 12-in. Slide-Valves and 12-in. Connections.

Gasholder, Double Lift, with Cast-Iron Tank, capacity 37,000 feet.

Gasholder, Double Lift, capacity 100,000 feet.

Gasholder, Double Lift, capacity 240,000 feet.

One 12-in. Governor, by Wright, London, with 12-in. Valves, Bye-Pass, and Connections.

Two 12-in. four-way faced Valves, by Cockey.

For further information, &c., apply to the undersigned.

R. MORLAND, Engineer.

GUILDFORD GASLIGHT AND COKE COMPANY.

THE Directors are prepared to receive TENDERS for the TAR and LIQUOR produced at their Works for the year ending June 30, 1881.

Tenders to be delivered to Mr. LONGWORTH, Gas Offices, GUILDFORD, on or before Tuesday, June 8, and from whom any required particulars may be obtained.

GAS PLANT FOR SALE.

THE Maidstone Gas Company having enlarged their Works, offer the following Apparatus for Sale in good condition:—

SCRUBBERS.—One Tower Scrubber 30 ft. high by 10 ft. diameter, with Distributor, and partly fitted with Livesey's boards.

CONDENSERS.—One Set of Annular Condensers, consisting of 9 Pipes 17 ft. high, outer diameter 2 ft. 6 in., fitted with 12-in. Valves complete.

ENGINES.—Two 12-Horse Power Horizontal Engines in very good condition.

STATION-METER.—By Milne and Son, in first-class condition, ornamental case, with Valves and Bye-pass complete; to pass 20,000 cubic feet per hour.

HYDRAULIC MAIN.—Six 8 ft. by 18 in. Hydraulic Main D wrought iron; 24 8 ft. 9 in. by 18 in. Hydraulic Main D wrought iron. Nearly new.

BRIDGE AND ASCENSION PIPES.—90 6 in. by 4 in. Bridge-Pipes, and a quantity of 6-in. Ascension-Pipes and Bends.

RETORTS.—31 Rounds, 15 in. diameter and 9½ ft. long, in two pieces. 2 Ovals, 21 in. by 15 in. and 9 ft. long, in one piece. All of Stourbridge Fire-Clay, and in good condition.

For further particulars and price apply to

JOHN WEST, Engineer and Manager.

Gas Works, Maidstone, April 21, 1880.

THE Directors of the Shelley and Shepley Gaslight Company, Limited, invite TENDERS for BRICK RETORTS, Two Beds of 5 each, and other Extensions.

Further particulars may be obtained from the Manager to the above Company.

Tenders to be sent in on or before May 27, 1880, and addressed to WM. PEACE, Chairman.

SALFORD CORPORATION GAS-WORKS.

THE Corporation of Salford invite TENDERS for the Supply of CANNEL and COAL required at the various Gas Stations in Salford for One, Two, Three, or more years, commencing on 1st September next.

Forms of tender (upon which only tenders will be received) and all particulars may be obtained on application to the Engineer, Mr. Samuel Hunter, Gas-Works, Lamb Lane, Salford.

Tenders, endorsed "Cannel and Coal Contract," to be delivered to me on or before the 22nd of June next.

The Corporation do not bind themselves to accept the lowest or any tender.

By order,

CHRIS. MOORHOUSE, Town Clerk.

Town Hall, Salford, May 14, 1880.

CITY OF LIMERICK.

TO ENGINEERS.

THE Town Council of Limerick will receive PLANS for the Construction of Works to give, either by gravitation or otherwise, a Continuous Supply of Pure Water (assumed to be One million gallons daily at the least), proper and sufficient for all purposes and requirements—public, domestic, and otherwise—to the City of Limerick and its suburbs. The pressure to be such as will command at all times the highest elevation of all buildings.

An estimate of the expense of constructing the proposed Works to accompany each plan, and the probable time stated within which same can be completed.

The Council will not bind itself to accept or pay for any of the plans.

Plans, &c., under cover and seal, addressed to the "Town Council," to be delivered at the Town Clerk's Office, Town Hall, Limerick, on before the 15th day of July, 1880.

JOHN ELLARD, Town Clerk.

Town Hall, May 10, 1880

THE SHREWSBURY GASLIGHT COMPANY.

AMMONIACAL LIQUOR.

THE Directors of the above Company are desirous of receiving TENDERS for the Purchase of the Surplus AMMONIACAL LIQUOR made at their Works during the Three years commencing July 1, 1880.

The estimated quantity for disposal is about 1200 tons per annum, delivered into tanks on the London and North-Western Railway, or into boats on S.U. Canal (the latter preferred) at Shrewsbury.

Payments to be made monthly, net.

Tenders to state a separate price per Ton for Liquor of 5°, 6°, and 7° Twaddel, and to be sent in to the undersigned not later than June 7, 1880.

The Directors do not bind themselves to accept the highest or any tender.

By order,

WM. BELTON, Secretary and Manager.

Gas-Works, Shrewsbury, May 10, 1880.

TO COLLIERY OWNERS, &c.

THE Directors of the Barnsley Gas Com-pany hereby invite TENDERS from parties willing to Contract to Supply and to Deliver into the Retort Houses at their Works, situated at Old Mill and Pontefract Road, Barnsley, respectively, any quantity not exceeding 12,000 tons per annum of Screened Soft COAL or NUTS of the best quality, suitable for Gas-Making, that they may require for a period of One, Two, or Three years, as may be agreed upon, from Oct. 1, 1880. The said Coal to be delivered in a dry condition, free from smudge, dirt, shale, pyrites, or other impurities, at either of the said Works, in such quantities and at such times as the Manager may direct. There are railway sidings into both Works.

Sealed tenders, stating respectively the price of Coal or Nuts delivered as above, endorsed "Tender for Coal," and addressed to the Chairman, must be left at the Gas Company's Office on or before Thursday, the 3rd of June instant.

Any further information required may be obtained on application to the undersigned.

The Directors do not bind themselves to accept the lowest or any tender.

By order,

JOHN HUTCHINSON, Manager.

Gas Offices, Pontefract Road, Barnsley,
May 12, 1880.

IMPERIAL CONTINENTAL GAS ASSOCIATION.

(INCORPORATED BY ACT OF PARLIAMENT.)

The HALF-YEARLY ORDINARY MEETING of the Imperial Continental Gas Association was held at the City Terminus Hotel, Cannon Street, London, on Monday, the 24th inst.,

SIR JULIAN GOLDSMID, Bart., Chairman,

When the following resolutions were passed:—

Resolved unanimously—"That the Report upon the affairs of the Association now read be received, adopted, and entered on the minutes."

Resolved unanimously—"That a dividend of £5 per cent. be declared upon the £2,800,000 capital stock of the Association for the half year ended the 31st of December last, and a bonus of £1 per cent., and that the said dividend and bonus be payable, free of income-tax, on and after the 15th of June next."

Resolved unanimously—

"That Sir Julian Goldsmid, Bart., be re-elected a Director of the Association."

"That Nathaniel Montefiore, Esq., be re-elected a Director of the Association."

"That Francis Bassett, Esq., be re-elected a Director of the Association."

"That Thomas Newton Stokes, Esq., be re-elected an Auditor of the Association."

"That the cordial thanks of the meeting be given to the President and Directors, for their able management of the affairs of the Association, and to the Chairman for his conduct in the chair this day."

Upon the motion of the Chairman (Sir Julian Goldsmid, Bart.) a vote of thanks was also given to the Agents and Engineers on the Continent, and to the staff in England.

By order of the Board,
R. S. GARDINER, Secretary.

20, Clement's Lane, Lombard Street,
London, E.C., May 25, 1880.

TO COAL PROPRIETORS.

THE Directors of the Preston Gas Company

are prepared to receive TENDERS for the Supply of CANNEL and COAL for One, Three, or Five years.

Sealed tenders, endorsed "Tender for Cannel and Coal," must be delivered to the undersigned, on or before Wednesday, the 2nd of June next.

HENRY GREEN, Engineer.

Gas-Works, Preston, May 11, 1880.

EXETER GASLIGHT AND COKE COMPANY.

THE Directors of the Exeter Gaslight

and Coke Company are prepared to receive TENDERS for the Replating, &c., of a Double GASHOLDER at their Works.

Particulars may be obtained on application to the Engineer, at the Basin gas-works; and sealed tenders, endorsed "Tender for Repairs to Gasholder," to be sent to me, the undersigned, on or before Monday, June 14.

The Directors do not bind themselves to accept the lowest or any tender, nor will they pay for estimates.

By order,
W. A. PADFIELD, Secretary.

Gas Offices, Exeter, May 20, 1880.

BRISTOL UNITED GASLIGHT COMPANY.

SPECIFICATION AS TO SUPPLY OF COALS.

THE Directors of the Bristol United Gas-

light Company invite TENDERS for the Supply of about 100,000 Tons of GAS COALS, during the Twelve months between July 1, 1880, and July 1, 1881, for use at their Works, situated respectively at Avon Street, St. Philip's, Canons Marsh, and Stapleton Road, Bristol.

In the above-named quantity there is included about 10,000 Tons of Scotch or other Cannels, or other rich Gas Coals from the Northern or Midland Districts.

The Coal to be partly small and partly large or brush, and to be delivered in such monthly proportions as may be required by the Company, and in accordance with the season. The quality of the Coals must be good, dry, and free as possible from sulphur, bats, binds, refuse, and dirt.

Particulars required of the quality of the Coals for which tenders may be submitted; and the Directors will be glad to receive chemical analyses thereof, and any reliable information in relation to their properties for the manufacture of gas that the parties tendering may be able to supply.

Parties tendering must state the maximum quantities of either small, large, or brush Coal they will undertake to deliver monthly, and it must be understood that the Directors are to be at liberty to accept the terms offered for any lesser quantities they may think fit.

Tenders to state the prices per ton f.o.b. (port of shipment to be named), or delivered at Railway Station, Bristol, or at either of the Works of the Company, and the discount for monthly cash payments.

The Stapleton Road Works are adjoining both the Midland and Great Western Railways, from the latter of which the Company have a siding.

Payment will be made monthly for every ton of 20 cwt., as indicated by the weighbridges of the Company at their respective stations.

Sealed tenders to be addressed to the Chairman of Directors, Bristol United Gaslight Company, Canons Marsh, Bristol, marked "Tender for Gas Coal," and delivered not later than Tuesday, the 1st of June next.

HENRY H. TOWNSEND, Secretary.

Gaslight Offices, Bristol, May 7, 1880.

BURGH OF DUMFRIES,

THE Gas Committee of this Corporation

will receive ESTIMATES for the Supply of from 2000 to 3000 Tons of first-class CANNEL COAL, delivered at Dumfries Station, carriage paid, in quantities to be arranged, and within one year from acceptance. Luminosity not less than 28 candles, with good Coke. Payments monthly.

Offers, accompanied with analyses, may be lodged with WILLIAM MARTIN, Town Clerk, Dumfries, up to 29th curt.

Dumfries, May 18, 1880.

COAL CONTRACT.

THE Directors of the Newmarket Gas-

light Company are prepared to receive TENDERS for the Supply of 2000 Tons of Best Screened GAS COAL, to be delivered as required during the next Twelve months ending May 31, 1881.

Tenders, stating price per ton delivered free at the Great Eastern Railway Station, Newmarket, to be sent on or before Saturday, May 29, 1880, to the undersigned, from whom any further information may be obtained.

The Directors do not bind themselves to accept the lowest or any tender.

THOMAS WILKINSON, Manager.

SECOND-HAND ENGINES, EXHAUSTERS, BOILERS, &c.

THE Scarborough Gas Company invite

OFFERS for the Purchase of their present Duplicate Exhausting Machinery, comprising Two 7-in. Cylinder by 14-in. Stroke Horizontal Steam-Engines; Two 20,000 cubic feet per hour Gwynne and Beale's Patent Exhausters; Two Hydraulic Governors in Connection with Throttle Valves of Engines; and Two Cornish Boilers, 11 ft. by 3 ft. 9 in.

The whole are of superior make and have been carefully used, and are well worth attention, being about to be removed for replacement by larger and more powerful apparatus.

The machinery may be seen in operation until the 30th of April, and further particulars may be obtained on application to the undersigned.

By order,
WILLIAM J. MOON, Manager.

Scarborough, March 5, 1880.

THE Trustees for the District and Har-

bour of Maryport are prepared to receive TENDERS for the Purchase of the AMMONIACAL LIQUOR made at their Gas-Works for One year, commencing on the 1st of July next, and also for the Purchase of the Surplus TAR made at the said Gas-Works for a like term. Both to be delivered into the Purchaser's barrels at the Gas-Works.

The Trustees are not bound to accept the highest or any tender.

Sealed tenders, endorsed "Tender for Tar," or "Ammoniacal Liquor," as the case may be, to be sent to the undersigned on or before the 1st of June next.

JOHN BARWISE, Clerk to the Trustees.

Harbour Office, Maryport, May 12, 1880.

TENDERS FOR GAS COAL.

THE Corporation of Walsall invite

TENDERS for the Supply of 24,000 tons of Staveley, Yorkshire, or any other good GAS COAL, to be delivered during One year from the 1st of July next, either at the Walsall Railway Station, the Corporation siding at the new Gas-Works, or by boat at Walsall old or new Gas-Works. In the latter case it will also have to be unloaded and stacked in the coal-sheds, or such other places at the Gas-Works as may be directed. The Coal will have to be delivered at the rate of from 100 to 850 tons per week, as the Corporation may from time to time require.

Payments monthly.

The Corporation do not bind themselves to accept any tender, and they reserve the right to divide the contract between several firms.

Tenders, sealed and marked outside, "Tender for Gas Coal," and stating the price for large Coal, and also for Nuts, are to be sent to the undersigned on or before Wednesday, the 2nd of June next.

SAMUEL WILKINSON, Town Clerk.

Bridge Street, Walsall, May 14, 1880.

MANCHESTER CORPORATION GAS-WORKS.

TO TAR DISTILLERS AND OTHERS.

THE Gas Committee are prepared to

receive TENDERS for the Purchase of the whole or a portion of the GAS TAR to be produced at their Gaythorn and Rochdale Road Works during a period of Three or more years, commencing on the 1st day of March, 1881.

Sealed tenders, addressed to the Chairman of the Gas Committee, Town Hall, Manchester, and endorsed "Tender for Gas Tar," must be delivered here on or before Wednesday, the 16th day of June next.

The Committee do not bind themselves to accept the highest or any tender.

Further particulars and forms of tender may be obtained on application to Mr. Geo. B. Jackson, at the Gas Office.

By order,
JOS. HERON, Town Clerk.

Town Hall, Manchester, May 15, 1880.

CITY OF CARLISLE.

TENDERS FOR COAL AND CANNEL.

THE Carlisle Gas Committee are pre-

pared to receive TENDERS for the Supply of about 10,000 Tons of Screened or Unscreened GAS COAL, and about 2000 Tons of CANNEL, to be delivered in Carlisle in such quantities as may be directed, from July, 1880, to June, 1881.

Tenders, specifying the description of the Coal or Cannel, the pits at which they are raised, and the terms for net monthly payment, are to be sent to me on or before June 2, 1880, endorsed "Tender for Coal."

J. HEPWORTH, Engineer and Manager.

Gas-Works, Carlisle, May 20, 1880.

BANGOR LOCAL BOARD OF HEALTH.

TENDERS FOR GAS COAL.

THE Water and Gas Committee of the

above Board invite TENDERS for the Supply of the Best Screened GAS COAL, and also Screened CANNEL, for One, Two, or Three years, commencing the 1st of July next, at the following quantities per annum, viz.:—About 1200 tons of the Coal and about 150 tons of the Cannel, to be delivered (carriage paid) by railway at Bangor Station, and by sea at Hirael, Bangor (freight paid), in such quantities and at such periods as may be required.

Parties tendering must give full particulars as to the quality of the Coal and Cannel offered, and the name of the colliery from which they propose the supply.

Sealed tenders, under cover, endorsed "Tenders for Coal," addressed to the undersigned, will be received until the 5th of June next.

DAVID WHITE, Secretary and Manager.

Water and Gas Works, Bangor, Carnarvonshire,
May 15, 1880.

GAS COALS.

THE West Bromwich Improvement

Commissioners invite TENDERS for the Supply of about 9000 Tons of GAS COALS during the Twelve months between June 15, 1880, and June 15, 1881, for use at their Gas-Works situated at Albion, West Bromwich.

The quality of the Coals must be good, dry, and free as possible from sulphur, bats, bind, refuse, and dirt.

Particulars required of the quality of the Coals for which tenders may be submitted, and the Commissioners will be glad to receive chemical analyses thereof, and any reliable information in relation to their properties for the manufacture of Gas that the parties tendering may be able to supply. Samples to be sent with each tender. Tenders to state the price per ton, delivered at the Albion Station on the London and North-Western Railway, until the siding into the works is completed, and afterwards delivered on to the siding, and the discount for monthly cash payments.

Sealed tenders to be addressed to me, marked "Tender for Gas Coal," and delivered not later than Monday, the 31st of May inst.

CHAS. H. BAYLEY, Clerk.

Town Hall, West Bromwich, May 17, 1880.

IMPORTANT TO GAS MANAGERS.

NATIVE OXIDE of IRON direct from

the Mines always ready for prompt delivery. Price moderate. Spent Oxide re-purchased. Depôts: County Donegal and Runcorn.

Apply to GEO. BREWSTER, Falcaragh, Co. DONEGAL; or J. GOODWORTH, LEEDS, Manager in England.

GEORGE E. TOURNAY,

CONTRACTOR FOR THE ERECTION AND REBUILDING OF RETORT-BENCHES, CHIMNEY SHAFTS, &c.

RETORT SETTING A SPÉCIALITÉ.

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THE FIRST AND SECOND VOLUMES
OF

KING'S TREATISE

On the Science and Practice of the Manufacture and Distribution of

COAL GAS.

Edited by THOS. NEWBIGGING, C.E., M.Inst.C.E., and W. T. FEWTRELL, F.C.S.

Orders received by
WALTER KING, 11, Bolt Court, Fleet Street, London, E.C.

TO INVENTORS AND PATENTEES.

MR. W. H. BENNETT, having had

considerable experience in matters connected with Gas, Water, and Sanitary Improvement, begs to say that he continues to assist Inventors in the perfection of their designs, and to obtain for them PROVISIONAL PROTECTION, whereby their invention may be secured for Six Months; or LETTERS PATENT, which are granted for Fourteen Years.

Patents completed, or proceeded with at any stage, thereby rendering it unnecessary for persons resident in the country to visit London.

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Information as to cost, &c., supplied gratuitously upon application to the Advertiser, 22, Great George Street, WESTMINSTER.

Now ready, price 18s., bound in cloth, gilt lettered,

THE THIRTY-FOURTH VOLUME

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GAS MANAGER'S HANDBOOK.

By THOMAS NEWBIGGING, M.I.C.E.

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MR. FREDK. COLYER, M. Inst. C.E., informs his clients and friends his Offices are now at 18, GREAT GEORGE ST., WESTMINSTER, S.W., where he may be consulted upon any matter relating to Gas or Water Works.

Imperial
METER COMPY.,
LIMITED,
Makers of THE IMPROVED DRY GAS-METERS, THE PATENT WET GAS-METERS, Special Meters for Public Lighting, STATION-METERS, Governors, &c.
KING'S ROAD, ST. PANCRAS.
Formerly also (Walter Ford) at Gray's Inn Road.

OXIDE OF IRON.
Gas Companies can be supplied with any quantity of Natural Oxide suitable for Gas Purification purposes. Shipped direct from the extensive estates in Co. Donegal of the Earl of Leitrim and Wybrants Olphert, Esq., D.L.
By thus purchasing from the producer a constant supply of the purest material will be ensured to the Gas-Works, and intermediate profits will be saved to the Shareholders.
For terms, references, and particulars apply to
JOHN BEATTIE,
FALCARAGH, Co. DONEGAL, IRELAND.

ERECTION of CHEMICAL PLANT.
SPECIALITIES.
SULPHATE OF AMMONIA APPARATUS.
NON-CONTINUOUS AND CONTINUOUS PROCESSES FOR SMALL OR LARGE WORKS.
Liquor Ammonia Apparatus which does away with first making Crude Liquor and then Finishing. The Crude and Rectifying by my plan is worked at the *same* time throughout, in the same plant, with better results, and in half the time.
Assistance given in Erecting and Working Tar or Ammonia Works, either personally or by letter. Terms moderate.
Models of above plant, prices £2 2s., £3 3s., £2 10s. delivered.
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WILLIAM MACLEOD & Co.,
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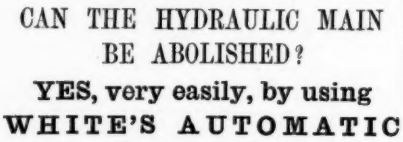
CAST-IRON GAS AND WATER PIPES.

DELIVERY F.O.B., GLASGOW.
Prices on application.

CAN THE HYDRAULIC MAIN BE ABOLISHED?
YES, very easily, by using
WHITE'S AUTOMATIC GAS-VALVE.
HERE'S PROOF:—
Gas-Works, Aberystwith, Jan. 24, 1880.
Mr. Wm. White, Abersychan, Mon.
Dear Sir,—The retorts fitted with your Valves answer very well. Our average make is 5600 cubic feet per mouthpiece, and we have no difficulty in producing 16-CANDLE GAS WITHOUT ANY CANNEL; although we formerly (with the old hydraulic dip-pipes) used a percentage to obtain that candle power. During the whole time they have been at work we have not been troubled with a choked ascension-pipe.
Yours respectfully,
J. DOUGALL, Engineer.
NOTE.—Other testimony to follow. Illustrated pamphlet descriptive of the system sent post free for 6½d. in stamps, on application to the Inventor and Patentee as above.

PRICE'S PATENT COKE & COAL BARROW

effecting a great saving of time, labour, and expense.
For particulars, price, &c., apply to Mr. E. PRICE, Inventor and Patentee, Gas-Works, Hampton Wick, MIDDLESEX.
Prices are Reduced.

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(Established 1820,)
FIRE-BRICK AND TILE MERCHANTS,
Wholesale and for Exportation,
FALCON DOCK, 78 AND 79, BANKSIDE, SOUTHWARK, LONDON, S.E.,
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GAS AND WATER WORKS.

WOOD TROUGHING
For Preserving Service-Pipes.
Price from Three-Farthings per Foot.
In any Lengths.
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THOMAS PROUD,
BROOKFIELD WORKS,
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MANUFACTURER OF
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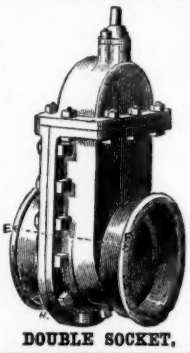
AND
GENERAL STEEL AND IRON TOOLS AND MATERIAL USED IN GAS-WORKS.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IMPROVED SCREW-VALVES,
For Water, Tar, Ammoniacal Liquor, &c.
MADE EITHER WITH FLANGED OR SOCKET ENDS.
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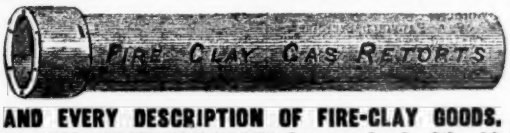

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ROBUS'S IMPROVED RETORT-SETTINGS, guaranteed to Carbonize a large amount of Coal with a small per cent. of Fuel.
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GAS ENGINEERS,
Gas-Meter, Gas Apparatus, and Gas-Fittings Manufacturers,
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WARNER'S RETORT-HOUSE MACHINERY.
[*As Illustrated and Described in the* JOURNAL *for May* 4.]
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HONOURABLE MENTION.

PARIS EXHIBITION, 1878.

J. E. WILLIAMS & CO.,

SOLE MANUFACTURERS OF THE

SPECIAL METALLIC OXIDE PAINT,

Largely used by Gas Companies, Corporations, Railway Companies, Ironfounders, and Machinists.

HONOURABLE MENTION.

PARIS EXHIBITION, 1878.

It has the following qualifications and properties:—

Effectually prevents and arrests corrosion.
Has a fine gloss, and is very durable.
Does not require driers like other paints.
Protects iron from action of water.

Is not affected by sulphuretted hydrogen.
Forms a very hard, tough (not brittle) surface.
Will not crack, blister, or scale.
Is not affected by extremes of temperature.

Covers nearly double the area of other paints. (7 gallons or 1 cwt. will cover 1211 square yards of ironwork.)
Is cheaper and more economical than any other.

VICTORIA PAINT WORKS, COLLYHURST, MANCHESTER.

ECONOMY IN THE PRODUCTION OF GAS.

PLUTONIC CEMENT,

FOR JOINTING AND REPAIRING RETORTS AND OVENS *in* ACTION AND *out* OF ACTION.

Pamphlet on the advantages of the above, with Modes of Application, References, Prices, &c., free by post, from the Sole Manufacturer,

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LIVESEY'S PATENT WASHER.

This apparatus effects the most intimate contact between the liquor with which it is supplied and the gas passing through it, resulting in the complete removal of all particles of tar, increasing the ammonia strength of the scrubber and condenser liquor, and removing a large proportion of other impurities—notably, carbonic acid. The Washer is intended to work in conjunction with a scrubber. It occupies little space, and is inexpensive. It does not become clogged with tar or corroded by the action of the liquor or gases, it gives three inches of pressure, and only needs a supply of liquor to keep it in regular action without any further attention. It has been in constant successful use for five years, and is now in operation in upwards of fifty places.

Prices, fitted and fixed complete, exclusive of Valves and Connections; all foundations and unskilled labour required in erection to be provided by the Gas Company:—

Quantities to pass in cubic feet per 24 hours	100,000	250,000	500,000	750,000	1 million	1½ million	2 million	3 million	4 million
Price each	£30	£50	£70	£95	£120	£165	£200	£280	£360

For further Particulars apply to

Messrs. DEMPSTER AND SONS, ELLAND, HALIFAX, for the North;
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Or to the PATENTEE, 589, OLD KENT ROAD, LONDON, S.E.

GOLDSMITH'S PATENT SIGHT WATER-LINE INDICATING GAS-METER.

MANUFACTURED BY GUEST AND CHRIMES,

FOUNDRY AND GENERAL BRASS WORKS, ROTHERHAM;
AND 85, SOUTHWARK ST., LONDON, S.E.

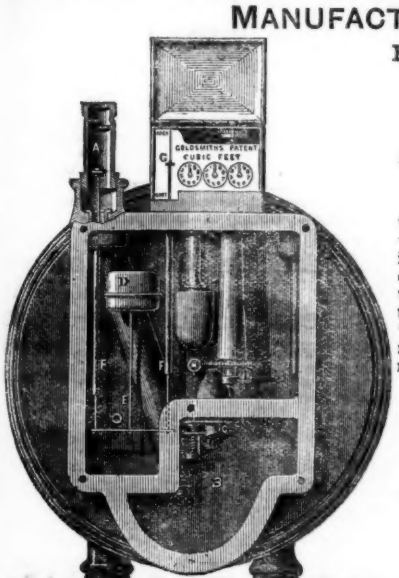


FIG. 1.—Three-light Meter, One-sixth Size.

Fig. 1 is a Meter with front removed to show the arrangement and connection of the Indicator and Valve.

Fig. 2 is front view of Index, with cover up.

The principal object of this invention is to render the water-line in the reservoir at all times visible. It will be seen, by reference to the illustrations, that this is accomplished in the following manner:—On the dial are the words "Open" and "Shut," and attached to the float is the pointer G, which rises and falls with the water-line in the reservoir. If the pointer is at "Open," it shows that the valve is open, and that the reservoir is full. If it is at "Shut," it shows that the reservoir is empty, and that the gas will be shut off.

The following ADVANTAGES will be obvious:—

1. The Inspector can see at a glance if the Meter requires water.
2. No more water than is required need be added, and therefore no water has to run out.
3. The Meter Inspector will be spared a great deal of his most objectionable work, and he will save a great deal of time and trouble.
4. The consumer will not always have to be asked for water, nor will he have to endure the unpleasant smell caused by waste water being run out.

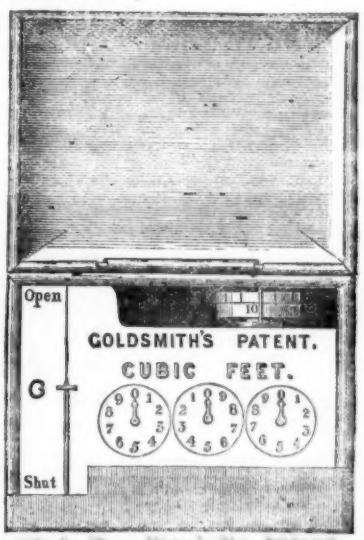


FIG. 2.—Three-light Index, Half Size.

BRAY'S
PATENT LANTERN AND FLAT-FLAME BURNERS.

80-CANDLE POWER LANTERN.

The understated declaration with which we introduced our apparatus has been fully borne out by general experience—namely, that

"THE FLAT-FLAME IS THE ONLY PRACTICABLE SYSTEM FOR STREET LIGHTING; and, 'in actual use,' yields as much light with Common Gas, and more with Cannel Gas, than any Argand System."

BIRMINGHAM LAMP TESTS

AFTER the most exhaustive series of experiments, extending over more than twelve months, with the most extensive assortment of Burners and Lanterns of large lighting power ever brought together, the Birmingham Authorities have

ADOPTED BRAY'S SYSTEM

for their Street-Lighting Improvements, for which purpose Sixty-Five 100-candle power Lanterns of medium lighting power are immediately required.

The apparatus used in the above tests were all of our usual medium lighting power class, and the tests showed that we sacrifice a considerable amount of lighting power for the sake of general efficiency. The tests further showed that our 80*-candle* HIGHEST *lighting power burner yielded* 3·51 *candles per foot of gas (the quality being* 16·75—3·35 *per foot—by the standard), which was a higher result than that yielded by any other flat-flame burner, and higher than the* 80*-candle power Argands.*

NOTE.—The above is the most conclusive answer to certain misleading statements which are being made by the most prominent of the defeated competitors.

Extract from the *Leeds Mercury*, April 1, 1880.

At the meeting of the Leeds Town Council, March 31, Alderman Gaunt moved that the Council approve of the acceptance by the Corporate Property Committee of the tender of Messrs. Geo. Bray and Co. for the supply of 21 new lamps, to be placed upon the pillars round the Town Hall. The Committee had tested Sugg's and other lamps, and found Messrs. Bray's the best. It was intended to have two 200-candles power and two 100-candles power, and 17 round the hall of 80-candles power. Mr. Lynd, in seconding the motion, said that he had had an opportunity of seeing different lamps tested at Birmingham, and he was in favour of Messrs. Bray's.

Extract from the *Daily Free Press*, Aberdeen, Jan. 1, 1880.

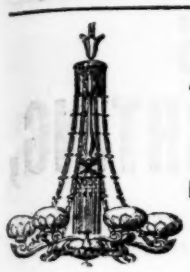
Judging of the merits of the lights as they appeared last night, on-lookers seemed to be generally of opinion that between Sugg's patent and Bray's larger light at the corner of Union Buildings, Castle Street, there was no perceptible difference in the illuminating power. When the vital question of gas consumption is taken into account, it is found that in the Castle Street lamps there is a marked difference in the quantity of gas consumed, for while 30 feet of gas are hourly burned in Sugg's Patent Lamp, only 20 feet are used by Bray's Lamp during the same period.

[The above Lamps have Meters attached.]

NOTE.—Mr. Sugg having freely advertised that among other places where his "burner and lantern have been adopted" is "Leeds," we have to state that, instead of having been adopted there, they have been discarded and returned to that gentleman months ago; nor is there one of his lanterns in the whole borough!

Bray's Lanterns have been adopted by the Vestry of St. George (which includes "WESTMINSTER"), Hanover Square, London, for all the crossings and refuges of that important district, after a direct competition with the Argand system of lighting; and also by about 40 Towns and Vestries, after a similar competition in most cases.

GEORGE BRAY & CO., BLACKMAN LANE, LEEDS.



F. & C. OSLER,

45, OXFORD STREET, LONDON, W.

MANUFACTORY AND SHOW-ROOMS:

BROAD STREET, BIRMINGHAM.

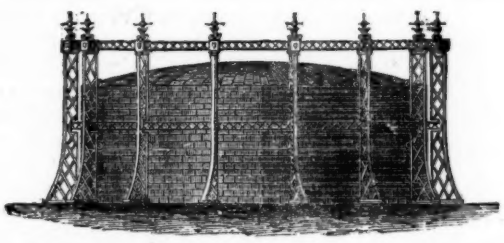
ESTABLISHED 1807.

MANUFACTURERS OF CRYSTAL GLASS CHANDELIERS,

WALL LIGHTS, AND LUSTRES FOR GAS AND CANDLES.

TABLE GLASS OF ALL KINDS.

CHANDELIERS IN BRONZE AND ORMOLU. MODERATOR LAMPS.



THE HORSELEY COMPANY,

LIMITED,

TIPTON, STAFFORDSHIRE.

LONDON OFFICE:

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GAS ENGINEERS, IRONFOUNDERS, &c.,

MANUFACTURERS OF

GASHOLDERS, WROUGHT AND CAST IRON TANKS, CONDENSERS, PURIFIERS, SCRUBBERS, MAINS, RETORT-LIDS, PLAIN AND DISHED, LAMP-POSTS, PIPES,

AND ALL REQUISITES FOR EITHER

GAS OR WATER WORKS;

ALSO

MAKERS OF ROOFS, BRIDGES, &c.

S. OWENS & CO.,

HYDRAULIC, GAS, AND GENERAL ENGINEERS,

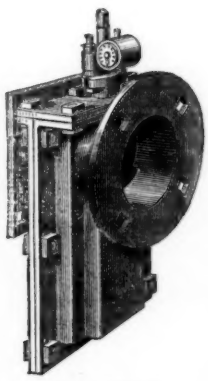
WHITEFRIARS STREET, LONDON, E.C.

Sole Manufacturers of MANN & OWENS'

PATENT SCREW & CAM GAS-VALVE,

Protected by Royal Letters Patent in England, France, Belgium, & the United States of America.

VALVE to OPEN DOWNWARDS.



BRIDGE-VALVE
for Regulating the Seal of
Hydraulic Mains.

VALVE to OPEN UPWARDS.

The SPECIAL ADVANTAGES of MANN AND OWENS' PATENT VALVE are as follows:—

1. Its non-liability to become set fast through varying temperature or from the deposit from crude gas. 2. It is made absolutely gas-tight by the simple action of a screw and cam. 3. Inconvenience through the breakage of springs or wedges setting fast cannot arise. 4. The face of the Valve is scraped and cleaned of any solid matter at each operation of opening or closing.

The Valve can be had to work either in a Vertical or Horizontal position.

Every Valve is carefully tested under pressure, and warranted perfectly sound and gas-tight.

INSTRUCTIONS FOR ORDERING.

State whether required for above or below ground, if Double Flange or Socket and Spigot Valves are wanted, or with loose Flanged Socket and Spigot pieces.

The Prices include Indicators to show extent to which Valve is open.

Also makers of PILLAR-VALVES, SELF-ACTING BYE-PASS VALVES, OUTSIDE RACK AND PINION VALVES, HYDRAULIC-MAIN VALVES, DISC-VALVES, &c.

Every description of Pumping Apparatus, Hydraulic Lifts, &c., suitable for use in Gas-Works, made to order.

PRICES, SIZES, AND FULL PARTICULARS, WITH COMPLETE ILLUSTRATED CATALOGUE, FURNISHED ON APPLICATION.

NOTICE TO MANAGERS OF GAS COMPANIES.

THE LAW UNION FIRE AND LIFE INSURANCE COMPANY, of No. 126, Chancery Lane, London, grants Policies of Insurance on Gas-Works, and Buildings connected therewith, which cover risk of explosion and spontaneous ignition of Coal, on very advantageous terms. Full particulars will be sent post free on application to

FRANK M'GEDY, Secretary.

126, Chancery Lane, London.

THOMAS CARR & SON,

MANUFACTURERS OF

FIRE-BRICKS, LUMPS, TILES, RETORTS, &c.,

SCOTSWOOD FIRE-BRICK WORKS, SCOTSWOOD-ON-TYNE.

Also Makers of all kinds of Common Building Bricks, and of Pressed White and Red Bricks for Facing.

JAMES OAKES & CO.,

ALFRETON IRON-WORKS, DERBYSHIRE,

AND

WENLOCK IRON WHARF, 21 & 22, WHARF ROAD, CITY ROAD, LONDON, N.,

Manufacture and keep in stock at their works (also a large stock in London) PIPES and CONNECTIONS 1½ to 48 inches in diameter; and make to order Retorts, Purifiers, and Tanks, with or without planed joints, Columns, Girders, Special Castings, required by Gas, Water, Railway, Telegraph, Chemical, Colliery, and other Companies.

NOTE.—Syphons and Covers are joint-faced if required, doing away with millboard and iron boring, or Syphons made without Covers, a socket being cast on and fitted with a small plug about 6 inches in diameter with lead joint. In either way preventing leakage.

MEMORANDUM FOR GAS COMPANIES.

TORBAY AND DART PAINT COMPANY, LIMITED,

SOLE PROPRIETORS AND MANUFACTURERS OF

WOLSTON'S TORBAY PAINTS.

OFFICES:

23, GREAT GEORGE STREET, WESTMINSTER LONDON, S.W.

WORKS:

DARTMOUTH AND BRIXHAM, DEVON.

TRADE MARK

These celebrated Paints are now very generally acknowledged to be the best and most economical in use. GAS COMPANIES especially have, by experience, proved that no others so fully meet their peculiar requirements, as they are not only UNAFFECTED BY GREAT HEAT and EFFECTUALLY RESIST SULPHURETTED HYDROGEN, AMMONIA, &c., &c., but they may be applied to GASHOLDERS that have hitherto been covered with the unsightly coal tar.

They are also cheaper than other paints and compositions; TWO COATS OF GENUINE WOLSTON'S TORBAY PAINT BEING EQUAL IN COVERING POWER TO THREE OF LEAD PAINT, or any of the numerous low-priced spurious oxides that are now in the market, whilst the durability of Wolston's is unrivalled.

The colours most approved for GASHOLDERS, PURIFIERS, SCRUBBERS, and all the plant and machinery used in and about Gas-Works, are—

FOR DARK TINTS.

No.	p. Cwt.	No.	p. Cwt.
13. Torbay Red	34s.	8. Bronze Green	36s.
6. Dart Brown	34s.	16. Torbay Chocolate	34s.
10. Carriage Red	34s.	4. Brixham Black	32s.
1. Torbay Brown	30s.		

FOR LIGHT TINTS.

No.	p. Cwt.	No.	p. Cwt.
7. Imperial Stone	34s.	19. Light Stone	36s.
29. Portland Stone	38s.	30. Bath Stone	38s.
31. Gray Stone	38s.	38. Buff	35s.

These Prices are for Paints in paste, carriage paid to any Gas-Works in Great Britain, in consignments of not less than 5 cwt.; but all the above colours may be had, READY MIXED FOR THE BRUSH, IN VARIOUS SIZED PAINT CANS WITH HANDLES, AT A UNIFORM PRICE OF 56s. PER CWT. (6d. PER LB.) carriage paid as above, in consignments of not less than 2 cwt., the sizes being 3 lb., 7 lb., 14 lb., and 28 lb. By taking the Paints in this convenient form, a considerable saving is effected in time, &c., as they can be immediately applied by any workman without the intervention of skilled painters to mix and prepare them; besides which all waste is avoided, and they may always be relied on as containing no adulterating or inferior material.

Where light colours are preferred, the work should be primed with two coats of No. 7, and finished with either of the other stone colours; and when the darker colours are selected, a priming coat of No. 13 is recommended.

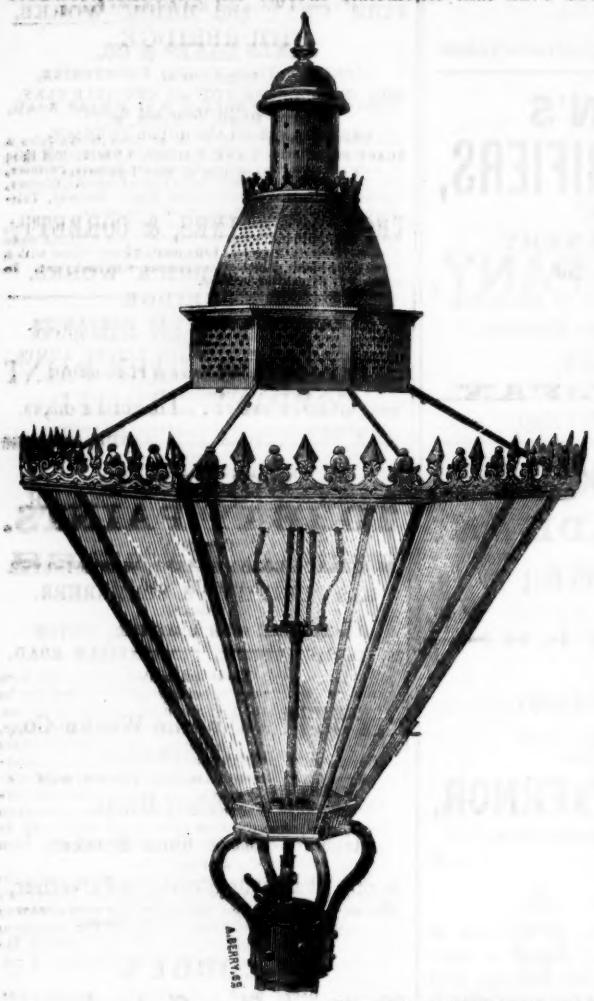
Specimen Cards forwarded and Inquiries attended to on application to

23, GREAT GEORGE STREET, WESTMINSTER, LONDON.

WILLIAM SUGG'S
IMPROVED SYSTEM OF STREET LIGHTING,

SUITABLE FOR CANNEL OR COMMON GAS.

NEW WESTMINSTER PATTERN LANTERN, the SUGG COMBINATION FLAT-FLAME BURNERS of 200 Candle Illuminating Power, as fixed by the Westminster Board of Works opposite the Houses of Parliament.



NOTWITHSTANDING the various statements that have been assiduously circulated of late, tending to prejudice Public Companies, Corporations, and Vestries against the recognized superiority of my large Argand Burners (established by tests made by eminent scientists, and confirmed by testimonials received from numerous Engineers of Gas-Works, which have appeared from time to time in the Advertisements of the JOURNAL), **the Highest Results** obtained at the recent trial of large Burners for Street Illumination held at Birmingham—where the most complete collection of large Burners and Lanterns extant had been assembled—were produced by the **200-candle and other large Argand Burners of my make**; clearly substantiating the statement I have repeatedly published, that the **Sugg Burners give over 30 per cent. Illuminating Power more than can be obtained from any other Burners with the like quantity and quality of Gas.**

It remains, moreover, to be mentioned that at the same trial my **Flat-Flame Burner,** with patent circular slit (patented 1875), produced the highest result in illuminating power of all the competitive Flat-Flame Burners present.

Amongst other places, the Burners and Lanterns have been adopted at—

PETERBOROUGH	LONDONDERRY	SWANSEA
SCARBOROUGH	SHEFFIELD	CARDIFF
EASTBOURNE	BELFAST	W. HARTLEPOOL
DURHAM	OLDHAM	SOUTHAMPTON
CHESTERFIELD	GLASGOW	PORTSMOUTH
CORK	DUBLIN	LEITH
NOTTINGHAM	HASTINGS	PAISLEY
LEICESTER	SUNDERLAND	PERTH
STOKE-UPON-TRENT	ROCHDALE	WIGAN
RAMSGATE	SOUTH SHIELDS	READING
BLACKBURN	IPSWICH	SALFORD
GREENOCK	BRIGHTON	MANCHESTER
LIVERPOOL	COLCHESTER	BIRMINGHAM
BOURNEMOUTH	NEWRY	LANCASTER
DONCASTER	GREAT GRIMSBY	

Buenos Ayres, Monte Video, Hong Kong, Singapore, New York, Philadelphia, San Francisco, Milwaukee, Quebec, Ontario, Ottawa, Boston, Sydney, Melbourne, Port Adelaide, Berlin, Vienna, Cologne, The Hague, Amsterdam, Rotterdam, Brussels, &c., &c.

Extract from the JOURNAL OF GAS LIGHTING, *&c., March* 16, 1880.

EXPERIMENTS IN IMPROVED STREET-LIGHTING AT BIRMINGHAM.

PUBLIC TRIAL, WEDNESDAY, MARCH 10, 1880.

After a prolonged inspection of the various Lanterns and Burners, tests were made by a shadow meter between Sugg's 200-candle Argand (No. 9), Bray's 200-candle Quadruple Bat's-wing (No. 10), and the Burner and Lantern as used by the Paris Gas Company in the Rue du Quatre Septembre (No. 12), with the results as shown in diagram, fig. 2. These appear to agree pretty nearly with the photometrical results obtained from each Burner, as shown in the preceding table (Mr. Hunt's Experiments, see page 404 of JOURNAL, March, 1880.)

PHOTOMETRICAL TRIALS.

No. 9. *Sugg's 200-Candle Argand Opal Top, Consumption per hour 44 cub. ft.*	*No. 10.* *Bray's 200-Candle Quadruple Bat's-wing, Consumption per hour 50 cub. ft.*	*No. 12.* *Burner and Lantern used by the Paris Gas Company in the Rue du Quatre Septembre, Consumption per hour 32 cub. ft.*
Light equal.		*Light equal.*
79·5 ft.	70·5 ft.	85 ft. / 65 ft.
150 ft.		150 ft.

FIG. 2.

NOTE.—The Lights were fixed on Posts in the manner they are used in the Public Streets.

THE RESULTS WORK OUT AS FOLLOWS:—

No. 9.	**No. 10.**	**No. 12.**
27 per cent. better than No. 10. = 191·7 Candles. Add 24·0 Candles for the extra 6 feet of gas required to equal the consumption of No. 10.	**= 151 Candles, or 8 per cent. better than No. 12.**	**= 92·8 Candles. If the consumption had been 50 ft., the Illuminating Power would have been at the same rate—138 Candles.**

Total 215·7 Candles, or 42 per cent. better than No. 10 for the same quantity of gas.

The next best on the List is Sugg's 100-candle Argand Burner, as fixed on the Refuges in the districts of the Phœnix Gas Company, London Gas Company, Commercial Gas, and Gaslight and Coke Company. They have been, moreover, definitely adopted by the Vestries of Lambeth, St. George's, St. Mary's (Rotherhithe), Lewisham Board of Works, St. Giles's Board of Works, as well as the Great Eastern, Great Northern, London, Brighton, and South Coast, and Metropolitan Railways.

The fact that over 1200 of these large Burners and Lanterns have been supplied to almost every Gas Company or Municipal Authority in England alone, within a very short time, speaks significantly of the excellence of this system, and the real merits it has been proved to possess.

PRICES AND PARTICULARS ON APPLICATION TO

WILLIAM SUGG, ENGINEER, VINCENT STREET, WESTMINSTER, S.W.

SMEATON'S TRAPLESS CLOSETS.

MESSRS. W. SMEATON & SONS,

HOT WATER AND SANITARY ENGINEERS.

PATENTEES AND INVENTORS OF THE
TRAPLESS, THE D TRAP, AND EDDYSTONE CLOSETS.
Also the New

ECLIPSE COMBINATION CAST LEAD TRAP.

The Price will be half of the old-fashioned D Trap, it being cast all in lead, without a Joint.
Send at once for an Illustrated Price List to their Wholesale and Retail Agent,

G. R. GLENIE,

WALBROOK HOUSE, 37, WALBROOK, LONDON, E.C.

A large Discount to the Trade and Shippers. Estimates Given and Contracts Taken.

R. DEMPSTER AND SON'S

WOOD SIEVES FOR PURIFIERS,

WITH TAPER OR PARALLEL BARS,

MADE BY SPECIAL MACHINERY.

SCRUBBERS FILLED WITH BOARDS,

On our approved principle, for the extraction of Ammonia.

Prices on application. References to First-Class Engineers.

ROSE MOUNT IRON-WORKS,

ELLAND, NEAR HALIFAX.

LONDON OFFICES: 2, SUFFOLK LANE, CANNON STREET, E.C.

J. & J. BRADDOCK,

GLOBE METER-WORKS, OLDHAM,

MANUFACTURERS OF

WET AND DRY CONSUMERS GAS-METERS,

OF THE HIGHEST EXCELLENCE ONLY;

ROUND STATION-METERS,

ON CAST-IRON STANDS;

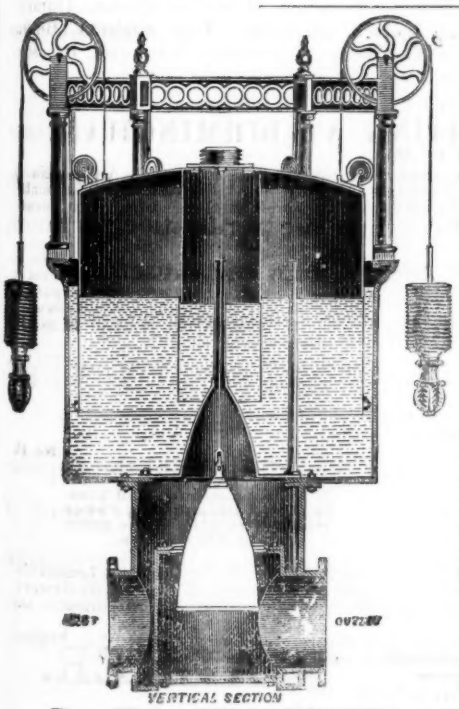
SQUARE STATION-METERS,

WITH PLANED JOINTS.

Messrs. BRADDOCK beg to submit to Gas Engineers their

PATENT COMPENSATING GAS GOVERNOR,

Which is designed to give an uniform pressure at the Outlet to the Main at all draughts up to the full quantities which the Governors are made to control, such outlet pressure being less than the initial pressure.



VERTICAL SECTION

The uniformity of pressure is obtained by introducing a compensating chamber into the Bell or Holder of the Governor, which compensator is of the same area as the valve, both of which are operated on by the initial pressure, thereby placing the valve in equilibrium, no matter what the initial pressure may be. The action on the Bell is by the Gas passing along a pipe from the outlet, and the pressure is regulated by weights in connexion with the Bell as required.

From the sectional elevation attached hereto, it will be seen that only the Gas required to operate the Bell comes in contact with the water of the tank, which water will remain comparatively sweet and free from odour. That in case of accident to the Bell, no more Gas can escape than would pass up the pipe covering the valve-rod and Bell supply-pipe.

These Governors have been made and sent out of various sizes for from 2 to 30-inch Mains, and give most satisfactory results.

They can be made with Float in the Bell, or counterpoise as per section.

C. & W. WALKER'S

WOOD PURIFIER SIEVES,

Which have now been used for fifteen years, and their advantages and durability fully established. They are made entirely by steam machinery in very large quantities at the most moderate cost.

MIDLAND IRON-WORKS,
DONNINGTON, NEAR NEWPORT, SHROPSHIRE.
FINSBURY CIRCUS, LONDON.

MOBBERLEY & PERRY,

FIRE CLAY and BRICK WORKS,

STOURBRIDGE.

Proprietors of
BEST GLASS-HOUSE POT and CRUCIBLE CLAY.
Manufacturers for Home and Export.
GAS-RETORTS, GLASS-HOUSE FURNACE,
BLAST-FURNACE, TANK BRICKS, LUMPS, TILES,
And Every Description of Best Fire-Bricks.

TROTTER, HAINES, & CORBETT,

BRETTELL'S ESTATE

FIRE CLAY & BRICK WORKS,

STOURBRIDGE.

Manufacturers of GAS-RETORTS, GLASS-HOUSE FURNACE & BLAST-FURNACE BRICKS LUMPS, TILES, and every description of FIRE-BRICK.
Proprietors of
BEST GLASS-HOUSE POT and CRUCIBLE CLAYS.
SHIPMENTS PROMPTLY AND CAREFULLY EXECUTED.

ESTABLISHED IN 1850.

BENJAMIN CARPENTER,

THE ORIGINAL MANUFACTURER OF
THE IMPROVED

WOOD SIEVES

FOR

GAS PURIFIERS & SCRUBBERS.

PROVIDENCE WORKS,
22, HERMES STREET, PENTONVILLE ROAD,
LONDON, N.

The Dunston Engine Works Co.,

GATESHEAD-UPON-TYNE.

Are the Sole Manufacturers of

Archer's Patent Hoists,

ALSO OF

Archer's Patent Stone Breaker,

AND OF

Archer's Patent Ore Crusher & Pulveriser,

The last-named Machine (without the Pulveriser) makes the best and most durable Coke Breaker.

GEORGE'S

Patent Gas Calorigen,

A STOVE FOR

WARMING AND VENTILATING.

RECOMMENDED BY DR. RICHARDSON.

MANUFACTURERS:

J. F. FARWIG & CO.,

36, QUEEN STREET, CANNON ST., LONDON.

Gold Medal Awarded, Paris Exhibition, 1878.

THOMAS TURTON
AND SONS,

SHEAF AND SPRING WORKS,

SHEFFIELD,

MANUFACTURERS OF

FILES OF BEST QUALITY

FOR ENGINEERS,

STEEL OF ALL DESCRIPTIONS,

SCREW STOCKS, TAPS, AND DIES, SPANNERS,
RATCHET BRACES, LIFTING-JACKS,
ANVILS, VICES,
AND ENGINEERS TOOLS GENERALLY.

LONDON OFFICE:

90, CANNON STREET, E.C.

THE

MANN & WALKERS' PATENT SCRUBBER.

Extensive use. The successful and extensive use of the Mann and Walkers' Patent Scrubbers in all parts of the world has demonstrated their advantages, and entitled them to be received with credit and confidence. The number of them in use is about twenty times that of any other known means of purifying gas from ammonia.

Small quantity of Water required. By a very small quantity of clean water (not more than 5 or 6 gallons per ton of coals carbonized) the whole of the Ammonia contained in the Gas is completely absorbed; the Gas, after only once passing through, issuing from the Scrubber outlet completely purified from Ammonia. The Scrubber gives no appreciable back pressure.

Residual Product obtained. The Residual Product—namely, the Ammoniacal Liquor—is obtained at from 20 to 30 ounces commercial strength, which enables it, after being mixed with the weaker Liquor from the hydraulic main and condensers, to be sold to the Manufacturing Chemists, or converted into Sulphate, at the degree of strength found most profitable to the Gas Company.

Illuminating power increased. The Scrubber is a Saturator, and the Gas being soaked in this strong solution of Ammonia in the lower columns of the Scrubber, is purified from a large amount of Carbonic Acid, and its Illuminating Power is thereby increased.

Small amount of power required. The friction is so little, and the motion so slow, that the power necessary to work the Scrubber is almost inappreciable. A small gas-engine will work a pair of Scrubbers, purifying 2 million cubic feet of gas per day.

Beckton Gas-Works. There are thirty of these Patent Scrubbers in the Beckton Gas-Works, equal to purifying 30 million cubic feet per day, and the total amount of engine power necessary to work the whole 30 is not equal to that given out by one 10-horse engine.

Reserve purifying power contained. There is also a most important advantage arising from the height of these Scrubbers, in the reserve force contained in them. In the event of any stoppage, the mass of soaked and wetted material would continue the purification for hours, even if the supply of water and working were stopped from any cause.

Internal Materials not changed. The changing of the soaking materials in these Scrubbers is very seldom required; they are well known to remain in action for seven years without being emptied.

Guarantee. They are in all cases erected under guarantees; they easily fulfil the stipulations of any Act of Parliament, and the chemical restrictions of the Board of Trade; and in cost they are much less to a Gas Company than any other known means of purifying Gas from Ammonia.

C. & W. WALKER.

8, *Finsbury Circus, London, E.C.*

LONDONDERRY GAS COALS

DIRECT FROM THE

MARQUESS OF LONDONDERRY'S COLLIERIES.

COUNTY OF DURHAM.

For Prices and Particulars, apply to

MR. S. J. DITCHFIELD,

LONDONDERRY OFFICES, SEAHAM HARBOUR, COUNTY OF DURHAM.

London Agents: Messrs. LAMBERT BROS., 85, GRACECHURCH ST., E.C.

GEORGE ORME & CO.,

ATLAS METER-WORKS, OLDHAM,

MANUFACTURERS OF

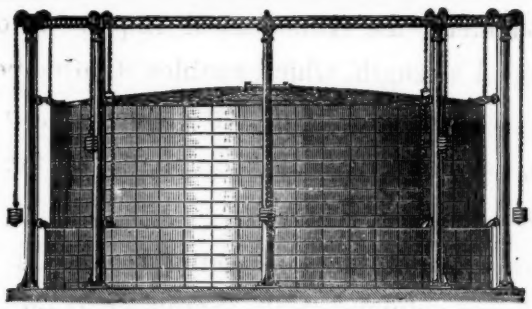
WET AND DRY GAS-METERS.

STATION-METERS, GOVERNORS,

PRESSURE AND EXHAUST REGISTERS,

LAMP-METERS IN CAST-IRON BOXES,

And every Description of Gas Apparatus.



J. T. B. PORTER & CO.,

GAS ENGINEERS & MANUFACTURERS,

IRONFOUNDERS AND CONTRACTORS,

GOWTS BRIDGE WORKS,

LINCOLN.

LONDON OFFICES: 1, WESTMINSTER CHAMBERS, S.W.

ESTIMATES FOR GAS-WORKS OF ANY SIZE.

REFERENCES TO 500 WORKS ALREADY ERECTED.

N.B.—All Communications to be addressed to the FIRM ONLY.

W. PARKINSON & CO.,

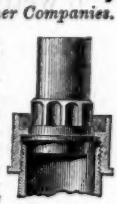
SOLE AGENTS FOR AND MANUFACTURERS OF

FOULGER'S PATENT SEAL UNIONS,

As Supplied to The Gaslight and Coke, Commercial, South Metropolitan, and other Companies.

These Unions practically place a Gas Company's property under lock and key, by rendering it impossible to disconnect at any joint at which gas can be obtained unregistered, without destroying the Company's Seal.

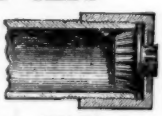
In fixing the Union (one being required on the main cock and another on the inlet only), some molten sealing-wax is poured into the recess on cap, and whilst hot impressed with Foulger's patent tong-shaped die, having the Gas Company's title engraved thereon; the wax being forced into the flutings on the lining, instant destruction of the Seal accompanies any attempt at disconnection.



SECTION.

FOULGER'S PATENT SEAL CUTTING-OFF CAPS

Cannot be taken off without destroying the Company's Seal. A tapered fluted plug (having been white-leaded or puttied) is inserted in the service-pipe. The cap (already filled with sealing-wax) is then screwed over, and tightens on a washer on the flange of plug. The wax is then warmed, and stamped with the engraved die. Absolute security against fraud and escape is thus obtained.



SECTION.

A great advantage will also be recognized in stopping the gas instantly with the plug, and consequent immunity from the present source of danger occasioned by escape during fitting the ordinary cap, frequently in a confined position, and often occupying a considerable time.

Small additional cost over existing connections.

COTTAGE LANE, CITY ROAD, LONDON, E.C.

T. NEWBIGGING,

CONSULTING GAS ENGINEER,

5, NORFOLK STREET, MANCHESTER.

HENRY LYON,

MECHANICAL AND CONSULTING GAS ENGINEER

NORWOOD, NORTHENDEN ROAD,

SALE, NEAR MANCHESTER.

SANDELL AND SON,

PUBLIC ACCOUNTANTS,

2, GREAT GEORGE STREET, WESTMINSTER.

SANDELL AND SON having been engaged during the past 25 years in Gas Companies Accounts, either in Preparing or Investigating Statements for Parliamentary Applications, Arbitrations, and otherwise, offer with confidence their Services for similar purposes.

ALFRED LASS, F.I.Accts.,

SPECIAL ACCOUNTANT FOR GAS AND WATER UNDERTAKINGS,

30, GRACECHURCH STREET, LONDON.

Accounts Analyzed and Statistics Prepared for Parliamentary Proceedings, Arbitrations, &c.

The Forms of Account, which have been specially designed by Mr. Lass to meet the requirements of the Gas-Works Clauses Amendment Act, 1871, are now in use by many Gas Companies, Corporations, and Local Boards.

JOHN ROMANS, C.E., F.G.S.E.,

CONSULTING GAS ENGINEER

AND

CANNEL COAL FACTOR,

30, St. Andrew Square, EDINBURGH.

Plans and Estimates furnished; Gas-Works, Apparatus, Pipes, Machinery, Fire Goods, &c., supplied, or Attested and Shipped for Exportation.

GAS-WORKS TAKEN ON LEASE.

MR. ROMANS has for upwards of 30 years been practically engaged in the Manufacture of Gas, and has, by extensive experiments, ascertained that by JUDICIOUS INTERMIXTURE of the lighter with the heavier gases, much of the rich Hydrocarbons CAN BE SAVED, which otherwise ARE LOST, during the process of manufacture. He is therefore enabled to give advice to those who favour him with their orders for Cannel, as to the class which will secure for their standard of illuminating power the HIGHEST ADVANTAGEOUS RESULTS.

ANALYSIS AND PRICES FORWARDED ON APPLICATION.

HARPER & MOORES,

PROPRIETORS OF THE

BEST STOURBRIDGE CLAYS,

STOURBRIDGE.

Manufacturers of all Descriptions of

BEST STOURBRIDGE FIRE-BRICKS, LUMPS, AND CLAY RETORTS

Of all Dimensions for Gas-Works,

GLASS-HOUSE POTS & CRUCIBLES

ESTABLISHED 1836.

The Highest Award was obtained by H. & M., at the Philadelphia Exhibition, 1876, for Superior Quality of Manufacture. SILVER MEDAL, PARIS, 1878.

BELGIAN CLAY RETORTS.

J. SUGG and CO., late ALBERT KELLER, GHENT.—The removal of the import duties on Earthenware permitting the entry of Clay Retorts into England, Messrs. Sugg, of Ghent, beg to draw the attention of the Gas Companies of London, and other Cities, to the very superior quality of the RETORTS manufactured by them. They can be made of any size, in one piece, and of any form. The price will be in proportion to the weight, and very moderate in comparison to their value.

Communications addressed to J. SUGG & Co., GHENT, will receive immediate attention.

RETORT BOLTS,

AND ALL KINDS OF

BOLTS AND NUTS,

SUITABLE FOR

GAS-WORKS,

SUPPLIED BY

JOHN STANSFELD,

Bolt & Nut Manufacturer,

ALFRED ST., BOAR LANE, LEEDS.

ROBERT MARSHALL,

CANNEL COAL MERCHANT,

198, ST. VINCENT STREET, GLASGOW.

SHOTT'S BOGHEAD.

HARTHILL CANNEL

Yields 14,920 cubic feet of 40·92-candle gas per ton.

THRASHBUSH CANNEL

13,580 cubic feet of 40·22-candle gas per ton, and 9 cwts. of good coke.

LOTHIAN'S CANNEL

Yields 12,500 cubic feet of 34-candle gas per ton, and 9 cwts. of excellent coke, containing only 4 per cent. of ash.

MUIRKIRK, No. 1, CANNEL

Yields 12,160 cubic feet of 32·5-candle gas per ton, and 10 cwts. of excellent coke, containing only 5 per cent. of ash. This cannel is almost free from sulphur.

OLD WEMYSS CANNEL

Yields 13,320 cubic feet of 32·5-candle gas per ton.

Prices and full analyses on application at above address, or from WEDDERSPOON, FERGUSSON AND Co., 21, Lime Street, LONDON, E.C.

HEBBURN MAIN GAS COAL.

This Coal is now highly approved of for gas making, and yields over 10,000 feet per ton of 15-candle gas, and about 14 cwt. coke.

For references and prices, either f. o. b. or by rail, apply to

W. RICHARDSON,

29, QUAYSIDE, NEWCASTLE-ON-TYNE.

GAS COAL.

THE MIRFIELD COAL COMPANY

are supplying GAS COAL of the best quality on trucks at their siding. This Coal contains 10 per cent. of Cannel, and, as analyzed by Mr. James Paterson, of Warrington, yields 12,600 *cubic feet of* 16·67*-candle gas, with* 1430 *lbs. of good Coke, per ton.* Ash in Coke, 1·88.

Apply to the MIRFIELD COLLIERY, Mirfield, NORMANTON. London Agent: Mr. F. J. LEE SMITH, 38 THROGMORTON ST.

WANTED, by Samuel Thompson & Co.,

Colliery Office, Lancaster, APPLICATION for PRICES from Gas Managers who are prepared to receive Tenders for GAS COAL or CANNEL.

John Leigh, Esq., M.R.C.S., F.C.S., &c., &c., in his analytical report of S. T. & Co.'s Coal, says: "It is remarkable for its purity, I have scarcely ever examined a Coal containing so small a quantity of ash, and when Cannel of the best description is scarce, it may well replace this material."

GAS COAL.

POPE & PEARSON, LIMITED, have

now the authority of several of the most eminent Gas Engineers of London in stating that their Coal yields *in practical working over* 10,000 *cubic feet of gas, with an illuminating power of* 16 *candles;* or by the standard burners now used by the London Gas Companies, an illuminating power equal to 17½ candles.

One ton yields 12½ cwt. of good coke. This Coal can be shipped from Hull, Goole, Liverpool, Morecambe, and Barrow.

For further particulars, apply to POPE AND PEARSON, LIMITED, West Riding and Silkstone Collieries, near LEEDS.

GAS COAL.

THE Tawd Vale Colliery Company,

Limited, are prepared to Contract for the Supply of their superior Arley and other GAS COALS, and to send samples to the order of Gas Engineers and others, or complete Analysis, on application. Shipped at Liverpool, Preston, Fleetwood, Garston, or Birkenhead.

Mr. James Paterson, C.E., F.G.S., in his analysis of T. V. Arley Coal, says: "Some parts merge into a semi-Cannel; gas per ton, 10,300 cubic feet; illuminating power, 16·96 candles; coke of high quality, 1431 lbs. per ton."

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BIRTLEY IRON WORKS,

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Manufactory for every description of Casting and Machinery for Gas-Works and Water-Works.

Warehouse in London for Cast-Iron Pipes and Connexions of all sizes and in any quantity, Scott's Wharf, Bankside, Southwark.

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THE

SILICA FIRE-BRICK CO.,

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Near SHEFFIELD,

Manufacturers of THE ORIGINAL SILICA OR DINAS FIRE-BRICKS. Specially adapted for Gas-Retort Furnaces and for Siemens's Gas-Furnaces. Shipments promptly executed to London, Liverpool, Hull, Grimsby, &c.

FERRAND DAVIES,

148, GRESHAM HOUSE, OLD BROAD STREET, LONDON, E.C.,

AGENT FOR

THOMAS BARR'S LESMAHAGOW MAIN CANNEL,

AND

NEWTON, CHAMBERS, & CO.'S SILKSTONE GAS COALS.

Analyses and Quotations on application.

WILSON CARTER AND PEARSON,

GAS COAL AND CANNEL FACTORS,

Supply to any Railway Station or for Export all kinds of Fuel for Gas purposes.

Address—CHIEF OFFICES.

TEMPLE BUILDINGS, 50, NEW STREET, BIRMINGHAM.

GEORGE ANDERSON,

GAS AND CONSULTING ENGINEER,

35A, GREAT GEORGE STREET,

WESTMINSTER, S.W.,

PATENTEE and MANUFACTURER of the following Inventions:—

RETORT SETTINGS—giving great Economy of Fuel.

STEAM-ENGINES and EXHAUSTERS, FOUR-WAY VALVES, WASHERS, SCRUBBERS.

FUEL-MACHINE, for Compressing Breeze and Tar.

N.B.—Pamphlet, with Twenty-Eight Illustrations and Letterpress, on the Construction of Gas-Works, will be sent, post free, on receipt of 4s. in stamps To be had of the AUTHOR; or at the Office of the "JOURNAL OF GAS LIGHTING."

PRICES AND ALL PARTICULARS TO BE HAD OF THE PATENTEE,

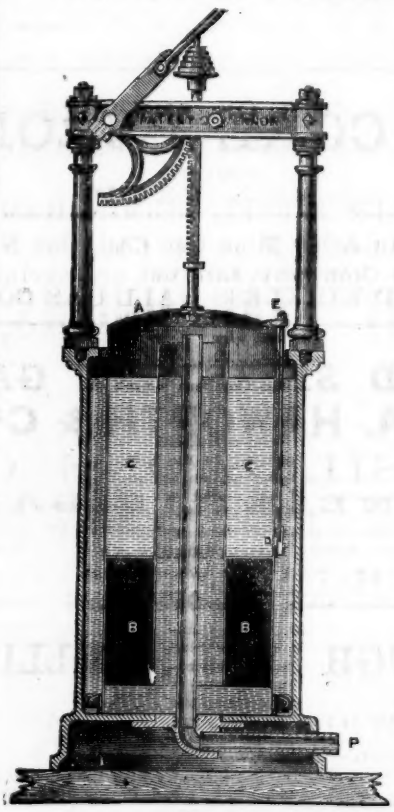
35a, GREAT GEORGE STREET, WESTMINSTER, S.W.

GEORGE WALLER & CO.,

GAS AND HYDRAULIC ENGINEERS,

Patent Compensating Steam Governor,

WITH SELF-CONTAINED WATER-BALANCE.



This is the most efficient and perfect Governor yet made to control and regulate the speed of Engines and Exhausters according to the varying make of gas, and maintain a steady gauge, whether working level or with six inches of seal.

It is the only Governor that will effectually control Condensing and Compound Engines, especially when the Exhauster is on light work, and the Engine is large.

During the drawing and charging of Retorts, the Engine requires no attention—a matter of great importance in small works.

Descriptive Circular sent on application.

They are in use at
BECKTON,
HAMPTON WICK,
DUKINFIELD,
HARTLEPOOL,
NEWCASTLE-ON-TYNE,
RAMSGATE,
SUTTON,
and about 30 other works.

G. W. and Co. make **special Steam Throttle Valves,** suitable for working with this Governor, and alter existing Throttle Valves to same plan.

See also advertisement, page 803.

PHŒNIX ENGINEERING WORKS,

Holland Street and Bear Gardens, Southwark, S.E.

ALDWARKE MAIN AND CAR HOUSE COLLIERIES,

Near ROTHERHAM.

JOHN BROWN & CO., LIMITED,

ATLAS STEEL AND IRON WORKS, SHEFFIELD.

PROPRIETORS.

The Aldwarke Main Brights is a first-class gas-making and coking Coal, yielding by analysis 12,600 feet of 19-candle gas per ton, and giving "Weight of illuminating matter in lbs. of sperm, 820·80." It is very free from impurities and foreign matter.

Copies of Analyses made by Gas Companies who have used it will be forwarded and Samples sent on application.

THE LOCHORE & CAPLEDRAE CANNEL COAL COMPANY,

Limited,

Beg to intimate that the development of their Mines is progressing favourably, and that they are now in a position to supply their famous Cannels.

Quotations and full Analyses will be supplied on application addressed to the Company,

LOCHGELLY, FIFESHIRE, N.B.

Abstract of Analyses made by Dr. WALLACE, Gas Analyst for the City of Glasgow.

	Cubic Feet per Ton.		Illuminating Power.		Equivalent of a Ton in Sperm.
Plesio Boghead	13,165	....	36·16	....	1632
Brown Capledrae.	12,210	....	38·46	....	1610

MESSRS. FLETCHER, BURROWS, & CO.,

ATHERTON COLLIERIES, near MANCHESTER,

ARE PREPARED TO MAKE CONTRACTS FOR THE SUPPLY OF

CANNEL AND OF THEIR **ARLEY MINE GAS COAL,**

WHICH ARE OF ACKNOWLEDGED EXCELLENCE.

Their Coal is in use in the Salford, Stafford, Bolton, and other large Gas-Works in England, Ireland, Wales, and Abroad, giving in practical working 10,300 feet of 17-candle Gas, and 15 cwt. of superior Coke per Ton of Coal.

GAS COAL. GAS COAL. GAS COAL.

WELLS, BIRCH, RYDE, and CO., Limited,

HOYLAND SILKSTONE COLLIERIES,

Near BARNSLEY.

This Company is now in a position to raise **2000 tons per day of REAL OLD SILKSTONE GAS COAL.**

"The quality of this Coal for Gas purposes, if equalled, is not excelled by any on record, and the Coke competes successfully with best Durham."—See *Mining Journal*, Aug. 11, 1877.

Prices quoted to any Railway Station, or F.O.B. Hull, Grimsby, Goole, Keadby, Liverpool, and Fleetwood.

Full particulars will be sent on application to above address.

THE WIGAN COAL & IRON COMPANY,

LIMITED.

MIDLAND DISTRICT OFFICE: 97, NEW STREET, BIRMINGHAM; AGENT: A. C. SCRIVENER,

Supply the Best Wigan Arley Mine Gas Coal, Gas Nuts, Gas Cannel, &c.

N.B.—The Wigan Coal and Iron Company, Limited, are exclusive owners of the well-known HAIGH HALL AND KIRKLESS HALL GAS COAL COLLIERIES.

REAL OLD SILKSTONE GAS COAL.

C. A. HAWORTH & COY.,

STANHOPE SILKSTONE COLLIERIES,

SILKSTONE, NEAR BARNSLEY,

are prepared to supply their celebrated **Real** Old Silkstone Gas Coal and Nuts. Prices quoted to any Railway Station, or f.o.b., Hull, Goole, Keadby, Grimsby, Liverpool, and Fleetwood. Every information given on application to above address, or to their Agent,

ALBERT USHER, 5 Office, Finsbury Park, London, N.

THE BLAINSCOUGH HALL COLLIERY COMPANY.

BEST WIGAN ARLEY GAS COAL.

Yielding (as per analysis) 11,970 cubic feet of 16·39 candle gas per ton. Copies of analyses and testimonials from **Gas Companies and Managers**, who have used the Coal in large quantities for several years, will be forwarded on application.

Postal address, **CHORLEY**, Lancashire.

Waggon address, **COPPULL SIDING**, near **WIGAN**, London and North-Western Railway.

SAMPLE QUANTITIES SENT ON APPLICATION.

NEW PATENT WET GAS-METER,
THE "RELIANCE,"

MANUFACTURED BY THE

GAS-METER COMPANY, LIMITED,

238, KINGSLAND ROAD, LONDON; UNION STREET, OLDHAM; HANOVER STREET, DUBLIN.

SOLE AGENT FOR SCOTLAND: JAMES KEITH, EDINBURGH AND ARBROATH.

The object attained by this invention is the *correct measurement of Gas under every fluctuation of the pressure.*

Accuracy is obtained by subjecting the whole of the water which determines the measuring chambers of the drum to one uniform even pressure, and so prevents unequal displacements of the water-line.

The "RELIANCE" METER has been tested by several of the most experienced official meter inspectors. Copies of their reports may be obtained on application to the

GAS-METER COMPANY, LIMITED,
238, KINGSLAND ROAD, LONDON.

ALEXANDER WRIGHT & CO.

WET & DRY GAS METERS.

STATION METERS AND GOVERNORS.

JONES'S THROTTLE-VALVE GOVERNORS.

JONES'S DISTRICT GOVERNOR,

The simplest and best Instrument extant for checking Excess of Pressure in hilly districts.

GAUGES AND TESTING APPARATUS OF ALL KINDS FOR GAS.

55, 55a, & 56, MILLBANK STREET, LONDON, S.W.

R. LAIDLAW AND SON,

EDINBURGH AND GLASGOW.

Manufacturers of

CONSUMERS IMPROVED WET GAS-METERS,

THE UNVARYING WATER-LINE GAS-METERS,

IMPROVED DRY GAS-METERS, in Cast-Iron or Tin-Plate Cases;

STATION-METERS, ALL SIZES, with PLANED JOINTS;

Experimental Meters, Photometers, Pressure-Gauges, Governors, Test Holders, &c., &c.

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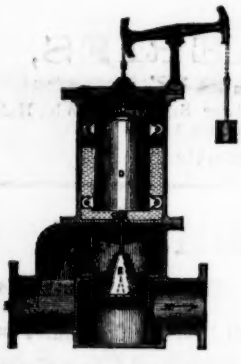
PEEBLES'S
PATENT GAS GOVERNORS,



Patent Safety Station-Governor.

FOR

Stations, Districts, Public Lamps, & Dwelling-Houses,

Are meeting with increasing favour, and giving full satisfaction where they are in use.

Wet and Dry Gas-Meters of Superior Excellence, Station-Meters, &c.

Prices and Illustrations Post Free on Application.

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